Gaining perspective of Indian Horticulture in Amrit Kaal using digital technology

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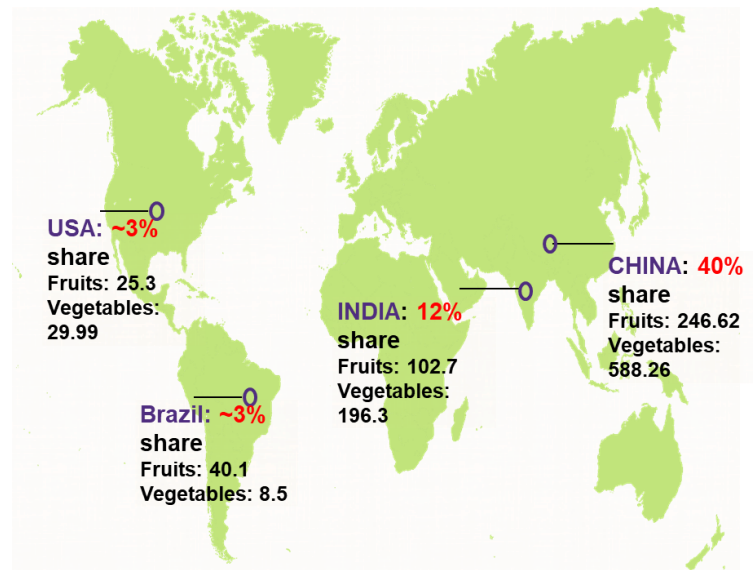**malhotraskraj@gmail.com, vc.mhu@gmail.com**

Plenary Lecture in National Conf on Paradigm and dynamics of digital
horticulture for food, nutrition and entrepreneurship organized by CHAI/ASMF
at GAU, Junagarh, 28-30, May, 2024

Horticulture in India- Great strides

(Base year1950-51 to 2023-24)

- **14 times Horticulture (25 to 355 million ton)**

Horticulture revolution : Nutrition & Health

USA: ~3% share
Fruits: 25.3
Vegetables: 29.99

CHINA: 40% share
Fruits: 246.62
Vegetables: 588.26

INDIA: 12% share
Fruits: 102.7
Vegetables: 196.3
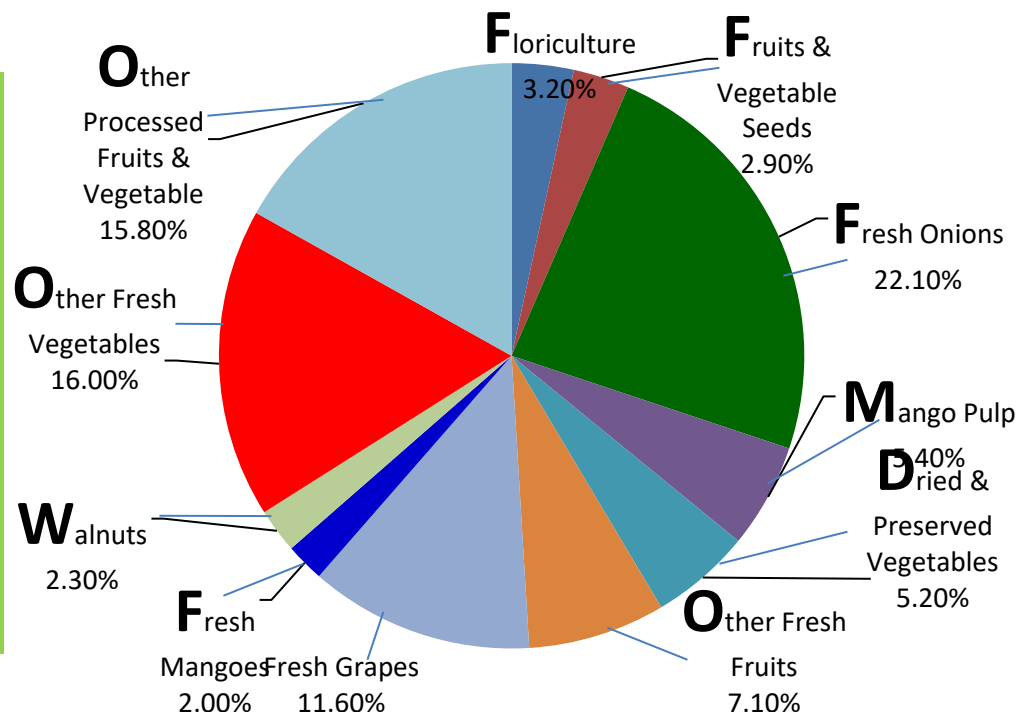
Brazil: ~3% share
Fruits: 40.1
Vegetables: 8.5

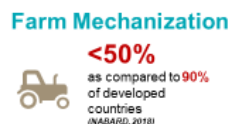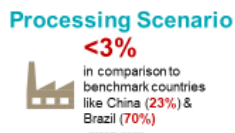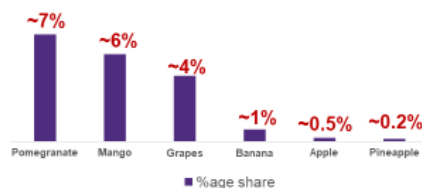# On the way to acquire Global leadership in Horticulture……

HORT EXPORTS
Annually (Crores)
- Fresh & processed Fruits, Veg, flowers: Rs. 26685 cr
- Spices : Rs. 27193 cr
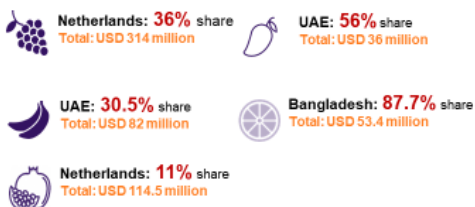- Hort. Export: 6.9 billion $
- 14% of total Agri export

Pie chart:
- Floriculture 3.20%
- Fruits & Vegetable Seeds 2.90%
- Fresh Onions 22.10%
- Mango Pulp 40%
- Dried & Preserved Vegetables 5.20%
- Other Fresh Fruits 7.10%
- Fresh Grapes 11.60%
- Fresh Mangoes 2.00%
- Walnuts 2.30%
- Other Fresh Vegetables 16.00%
- Other Processed Fruits & Vegetable 15.80%

India's Positioning at Global Level

Production Scenario
1st   2nd

Processing Scenario
<3% in comparison to benchmark countries like China (23%) & Brazil (70%)
(MOFPI, 2019)

Farm Mechanization
<50% as compared to 90% of developed countries
(NABARD, 2018)

India's Share in Global Export
- Pomegranate ~7%
- Mango ~6%
- Grapes ~4%
- Banana ~1%
- Apple ~0.5%
- Pineapple ~0.2%

■ %age share

Source: UN COMTRADE, FAOStat (2019)

Major Fruit Export Destinations from India
- Netherlands: 36% share Total: USD 314 million
- UAE: 56% share Total: USD 36 million
- UAE: 30.5% share Total: USD 82 million
- Bangladesh: 87.7% share Total: USD 53.4 million
- Netherlands: 11% share Total: USD 114.5 million

Source: FAOStat (2019), APEDA(2021), Agri-exchange, G7 analysis

World map:
- USA: ~3% share, Fruits: 25.3, Vegetables: 29.99
- Brazil: ~3% share, Fruits: 40.1, Vegetables: 8.5
- INDIA: 12% share, Fruits: 102.7, Vegetables: 196.3
- CHINA: 40% share, Fruits: 246.62, Vegetables: 588.26
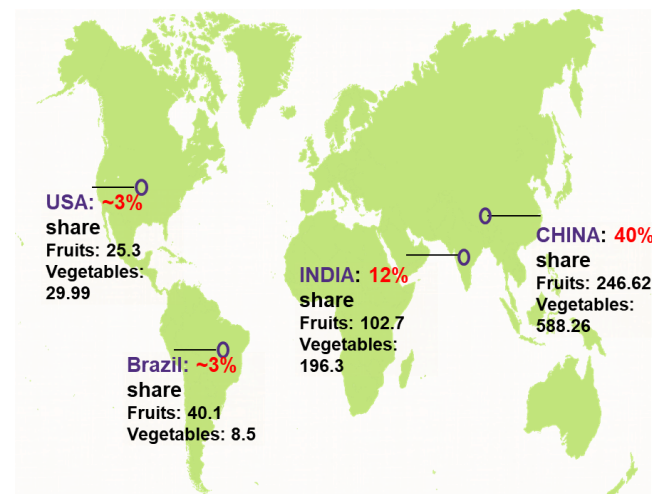
Knowledge powered solutions made the impact

- **Advancement in genetic resources utilization : development of new varieties & hybrids**

- **Quality planting material: Mass multiplication Innovative propagation**

- **Root stock technology – combat soil-stresses-**

- **Framework - Plant architecture engineering**

- **Increased irrigation efficiency**

- **Efficient management of pests.**

- **Technologies & infrastructure to reduce post harvest losses.**

SUCCESS DRIVERS

- **Strong Technology Back up**

- **New Initiatives in Horticulture Development**

- **Favourable Policy Environment**

But how to meet increasing demand

Indian Agriculture Now and at 2047

Parameter	2023	2047
1. Food grain production (Mt)	330	520
2. Fruit production (Mt)	**112**	**244**
3. Vegetable production	**207**	**405**
4. Nutri-, coarse cereals (Mt)	51	74
5. Milk availability (kg/day)	0.4	1.0
6. Farm mechanization (%)	47	75
7. Post-harvest losses (%)	15	10
8. Water use efficiency (%)	40	60
9. Nitrogen use efficiency (%)	35	50
10. Agri-export (% of world)	2.5	5.0

- **India needs 7.6% GDP and 4.9% agriculture growth to become developed by 2047: RBI**

- **India's per capita income needs to surpass US$ 21,664, from current US$ 2,500: World Bank**

Challenges in Horticulture: many to Address

1. Productivity enhancement
2. Increasing efficiency and reducing cost of production
3. Increasing quality intrinsic as well as extrinsic
4. Improving marketing and export
5. Reducing post-harvest losses
6. Reducing risks, uncertainty and drudgery
7. Reducing GHG emission in agriculture
8. Adapting to changing climate
9. Income security to farmers

Perspectives of Horticulture in Amrit Kaal (2023-2047)

1. Sustainable, efficient and inclusive growth

2. Climate-resilient agriculture

3. **Digital and secondary agriculture**

4. Import substitution and export promotion

5. Participation of private sector

Strategic Approach: To shape the future of Indian horticulture

- **Technology Integration**: Internet of Things, artificial intelligence, sensor utilization, automation to enhance efficiency, monitor crops, and manage resources.

- **Precision Management: T**argeted use of inputs, precise monitoring, and adaptive management techniques.

- **Climate Resilience: V**arieties and production techniques to withstand changing climatic conditions.

- **Supply Chain Coordination:** Efficient coordination among different stakeholders, including input suppliers, farmers, processors, and retailers, is crucial for seamless flow and timely delivery of horticultural products.

- **Market Intelligence:** Accurate market information and analysis, Understanding consumer preferences, market trends, and demand patterns, new market opportunities, potential export markets.

- **Diversification and Innovation**: Exploring novel crop varieties, value-added products, and innovative supply chain models to meet evolving consumer demands and create new market opportunities.

- **Sustainable Practices**: Environmental sustainability and social responsibility, sustainable farming practices.

- **Value Addition and Differentiation:** Adding value through branding, packaging, processing, and product differentiation strategies.

- **Logistics and Distribution**: Efficient logistics and distribution systems for timely and cost-effective delivery of horticultural products to consumers.

- **Policy Framework:** Formulating supportive policies that encourage investments in research, infrastructure, and human capital development, fostering an enabling environment for the growth of the horticulture sector.

Digitalization : Can drive innovation and transformation in Horticulture

5 Sectors in digitalization

1. **Precision Horticulture:** Application of sensors, Variable rate technology, Drones, Robotics, AI, Protected cultivation, Vertical farming, Hydroponics,

2. **Climate smart horticulture:** Weather monitoring, crop management, data management, Farm Management

3. **Supply Chain Management:** Quality management, Improving transparency, traceability and efficiency

4. **Financial inclusion:** Promoting financial inclusion, Unified Payment Interface (UPI), Mobile banking, Microfinance

5. **Use in Agriculture / horticulture education**

(Increase productivity, reduce waste, increase export, improve food, nutrition and income security)
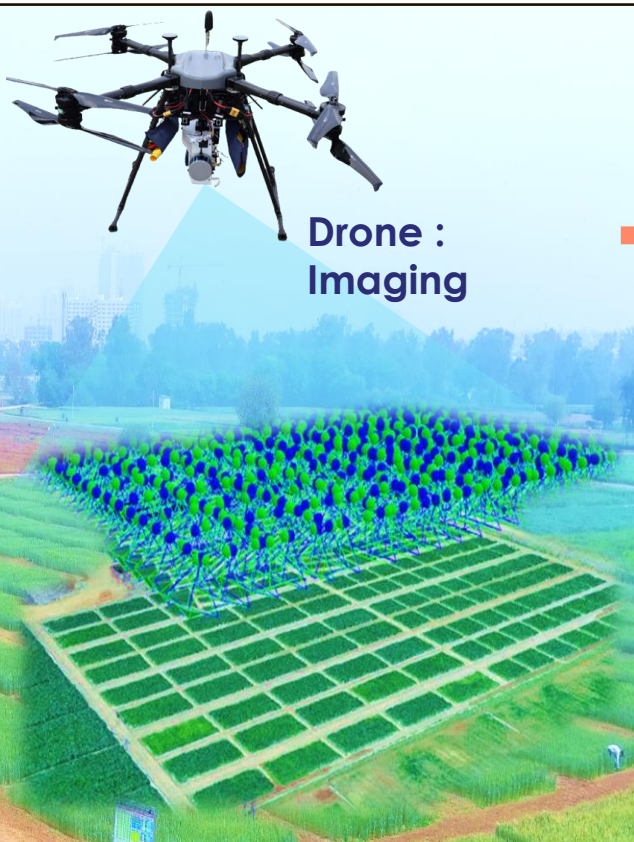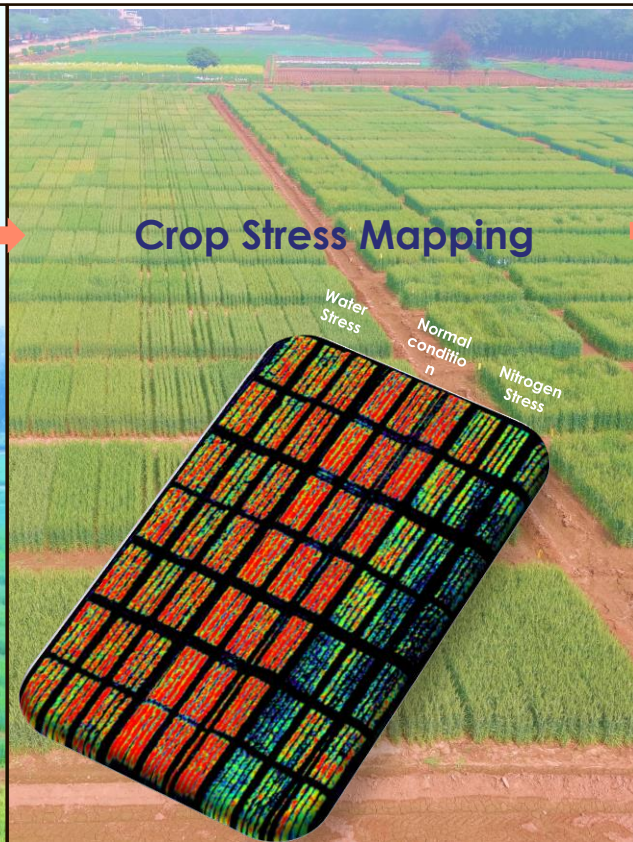
Precision Management of Soil, Water and Nutrient

➢ High throughput measurement of soil health using non-invasive sensors in the lab and air born sensors (< a minute per samples)

➢ Nano urea liquid is expected to potentially replace 13.7 million tons of conventional urea usage by 2023.

➢ IFFCO has also started field trials of the nano version of DAP fertilizer.

Sensor based system for banana tracking

Sensor based System tracks

✓ **Temperature**

✓ **Relative humidity**

✓ **Ethylene (ripening gas)**

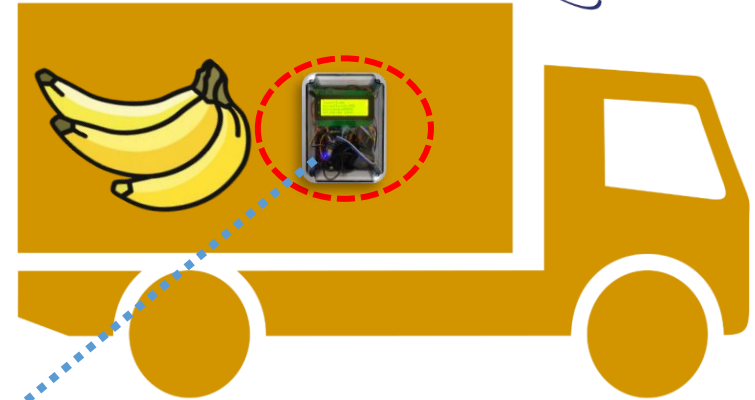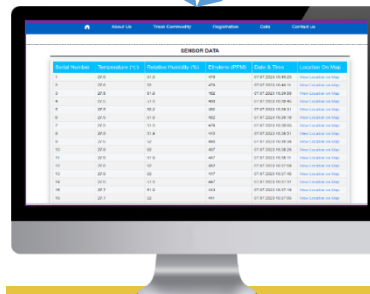✓ **Time and location**
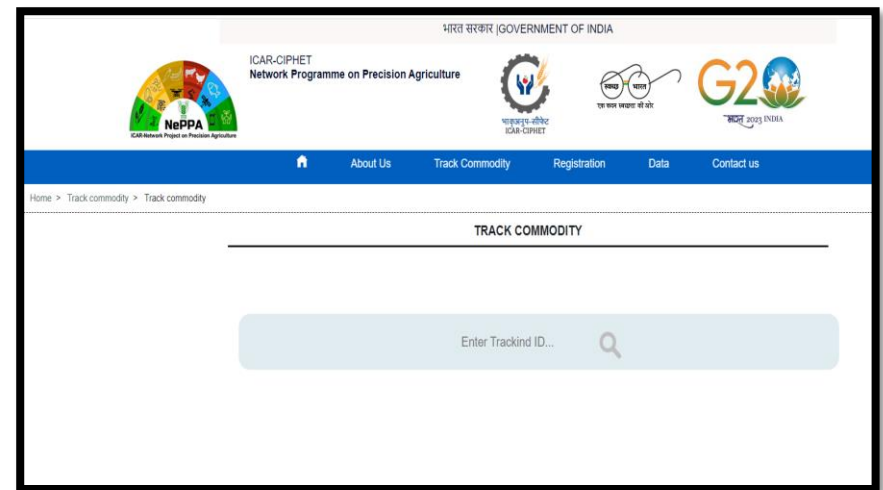
Track commodity using website

Application in supply chain

Cold storage Monitoring

Transportation Monitoring

Traceability

Sensor-based Multi-Pass Cleaner for Seeds

Feed hopper

Main frame

Unclean grain duct

Belt speed control

Light tight housing

Blower

Grain conveyor belt

Display
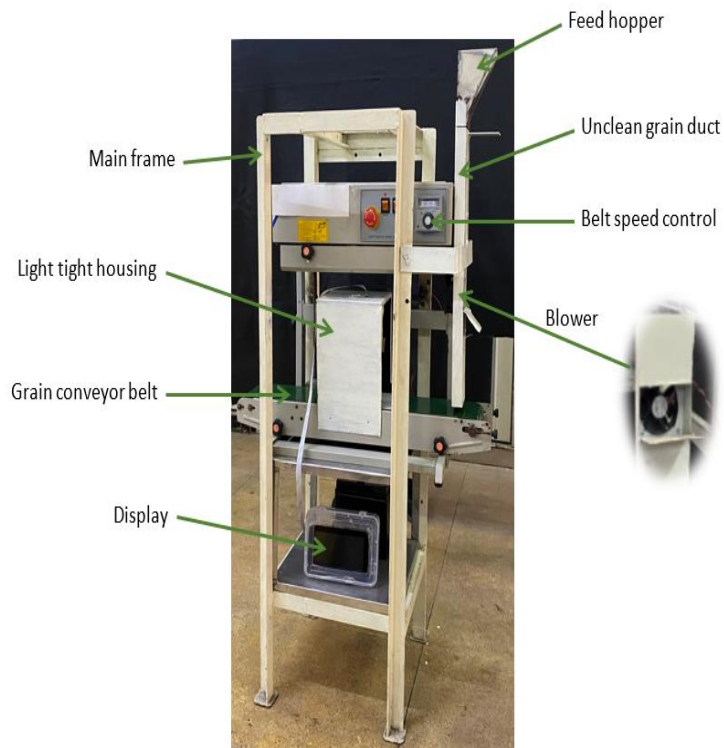
Multi-Pass Cleaner

Raw threshed grains on the belt

Material Annotation
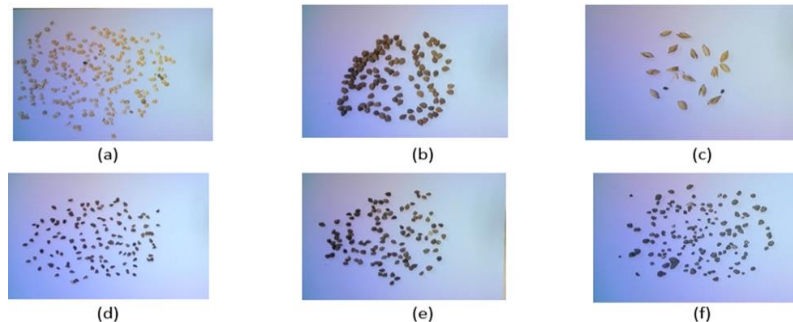
(a) Broken grains (b) Good grains (c) Husk (d) Immature grains (e) Infected grains (f) Stones

Segregation into different classes

Agricultural Mechanization
Intelligent Modernization for efficiency and prosperity

Gender Neutral Machines

Robotic Weeding

Robotic apple picking

Total farm machinery export from India – US$ 1005 million

Major export destinations for agro-machinery (2020-21)

16.9
9.7
4.1
3.5
3.3
3.2
2.9
2.7
2.1
2.0
46.7

- USA
- Nepal
- Sri Lanka
- Germany
- Bangladesh
- Thailand
- Algeria
- Myanmar
- Italy
- Tanzania
- Kenya
- Others
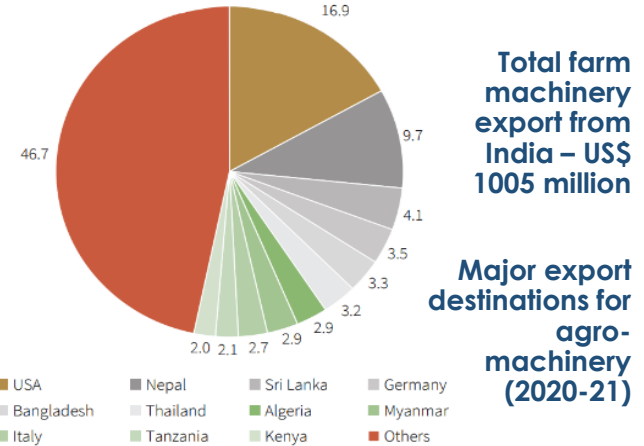
Tractor Production
India the World Leader

	1960	1980	2000	2020	2022
1000000					
500000					
0					

Farm Power Availablity (kW/ha)

	1960	1980	2000	2020	2023
2.00					
0.00					
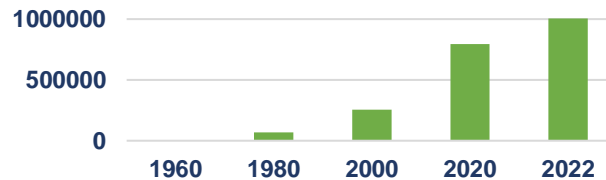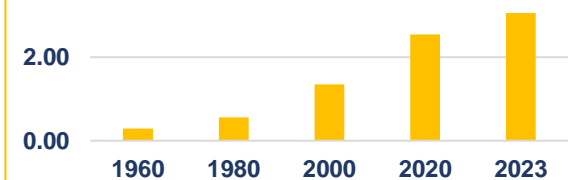
ICT in Agriculture

- **ICT Policy being prepared**

- **150+ mobile apps for different agricultural commodities and resource management**

- **Artificial Intelligence**

- **Block Chain Technology**

- **Big Data Analytics**

Enabling Digital Agriculture

Artificial Intelligence Based Disease Identification for Crops (AI-DISC) App

Data acquisition from different parts of India using NIBPP mobile app

Storing images and metadata in National Image Base for Plant Protection

Image pre-processing for data preparation
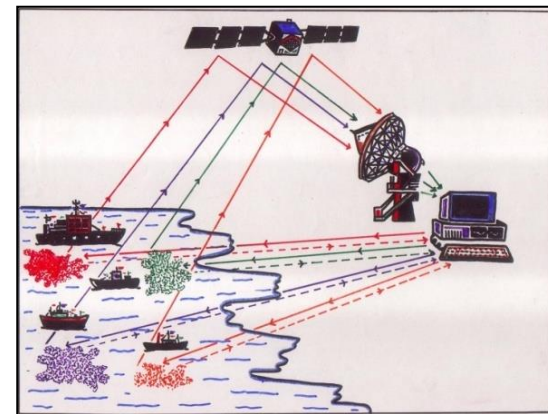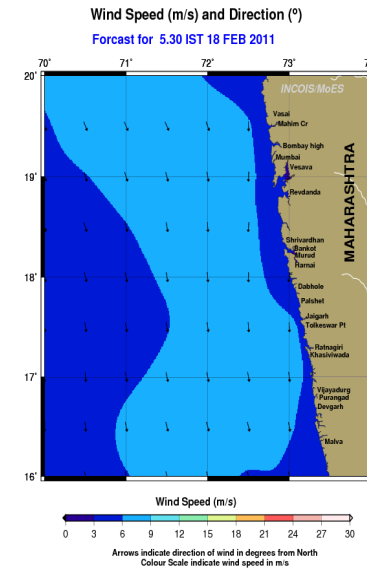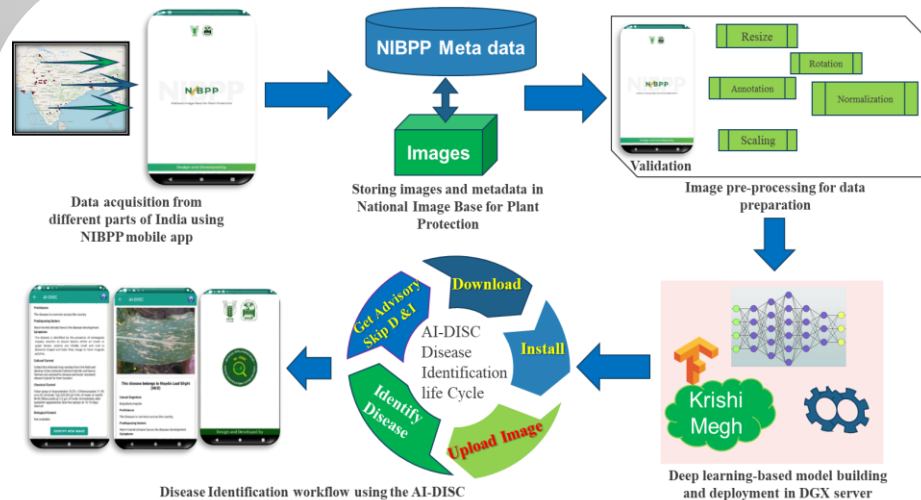
Deep learning-based model building and deployment in DGX server

Disease Identification workflow using the AI-DISC

Models

- Artificial Intelligence (Deep Learning) models for more than 20 crops (Rice, Wheat, Maize, Tomato, Mustard, Cotton, Brinjal, Apple, Peach, Kinnow, Mandarin, Assam Lemon, Chickpea, Green gram, Cluster bean, Moth bean, Chilli, Coriander etc.)
- Trained over 1.5 lakh images
- Developed and deployed in NVDIA GPU server at KrishiMegh

Features

- AI-enabled disease identification within fraction of seconds with over 95% accuracy
- Expert consultations facility via text/video chat
- Real time reporting system for disease infestation across India

AI-DISC App

AI-DISC (Artificial Intelligence-based Disease Identification System for Crops) is an AI-based mobile application for automatic detection of diseases of major crops using digital images. The app is aimed to provide the real-time crop protection solution to the extension workers, researchers and scientists at their fingertips. This application has the following key features:

- Automatic identification of diseases of crops using highly optimized AI-based models
- Crop protection-related advisory for the respective identified disease as prescribed by experts
- Expert Forum for users to discuss the issues related to crop protection with registered domain experts
- Report and access real-time news related to crop protection fed by users and reviewed by experts
- National level repository of images of crop diseases

Designed & Developed by:
**Division of Computer Applications
ICAR-Indian Agricultural Statistics Research Institute
New Delhi, India**
Under NAHEP Component 2 Project 'Investment in ICAR Leadership for Agriculture Higher Education'

Simple Steps to Identify Crop Diseases

- Download AI-DISC android mobile app (https://play.google.com/store/apps/details?id=com.ai.ai_disc)
- Upload image with visible symptoms
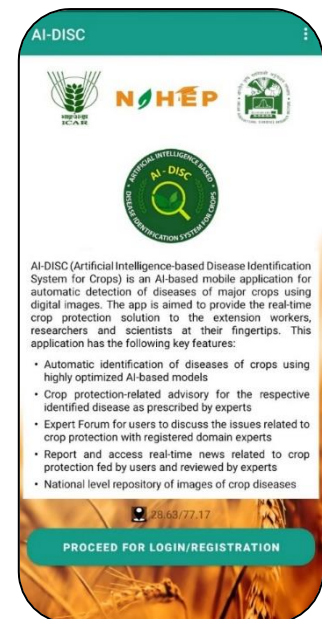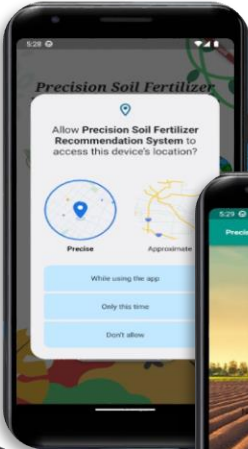- Get the disease and advisory automatically

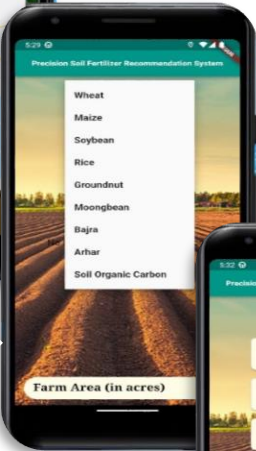# Rapid Soil Fertility Mapping for Fertilizer Recommendation
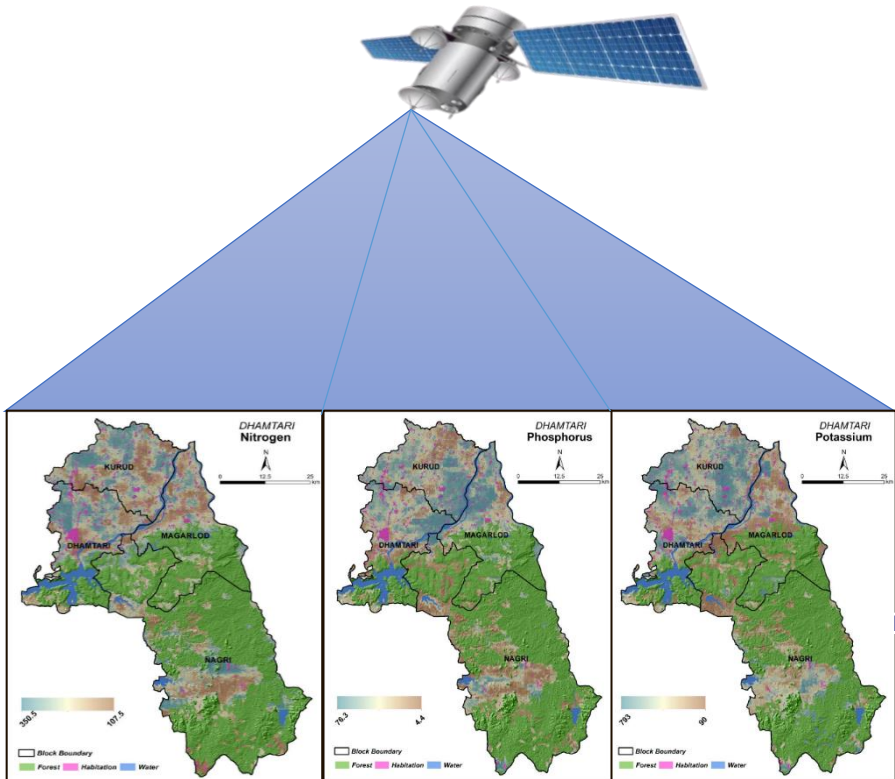
Remote Sensing based Digital Soil Fertility Map

Use friendly Mobile App

Locating the field

Choosing the crop

Advisory for Fertilizer

Imbalanced Fertilizer Use in India

Zone	Fertilizer Use (kg/ha)	N:P:K ratio
East	143.7	4.2:1.7:1
North	189.3	19.7:5.6:1
South	175.9	3.8:1.8:1
West	96.2	6.3:3.0:1
All India	**137.4**	**7.1:2.7:1**

- **Ideal fertilizer consumption ratio should be 4:2:1 but the present consumption is highly skewed towards Nitrogen**

- **85% of the total fertilizers are consumed in 290 districts and only 15% is consumed in remaining 449 districts**

Rationale of Fertilizer Use

Horticulture has never been in plan for assessment of need

Fertilizer availability: 56 million ton

For horticulture crops:8 million ton

Required (for hortic) :15 million ton

Gap : 7 million ton
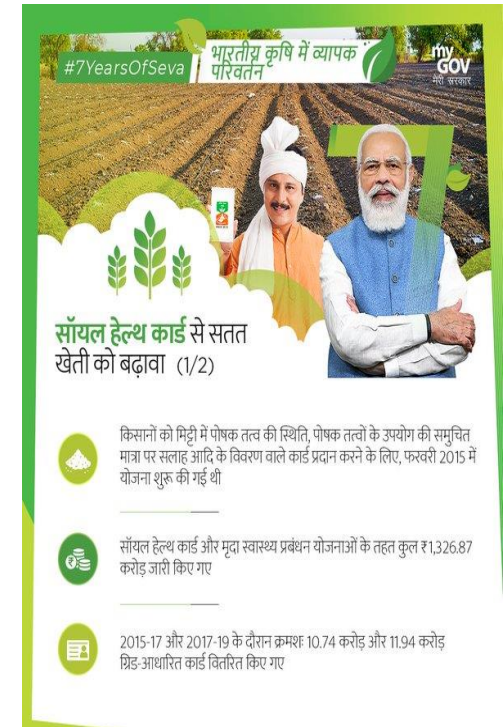
- **Biofertlizers : Rhizobium, Azotobactor, Acetobactor, Azospirillium, Phosphate/potash mobilizing bacteria and PGPR , consortia**

- Critical gaps in production and distribution

- Requirement: 6.8 lakh metric ton (MT)

- Production status: 2.3 lakh MT carrier/powder (447 units) & 25369 KL of liquid (133 units) based.

- **We need to enhance present capacity for biofertilsers to 3 times**

Marketing Fresh Fruits and Vegetables

Agricultural marketing system - Link between farm and non-farm sectors

Production stimulates forward linkages- regional production/marketing

Market needs – demand driven than supply driven

Farmer to be price setters than price followers

Needs market information system- Horticulture led agricultural growth in India
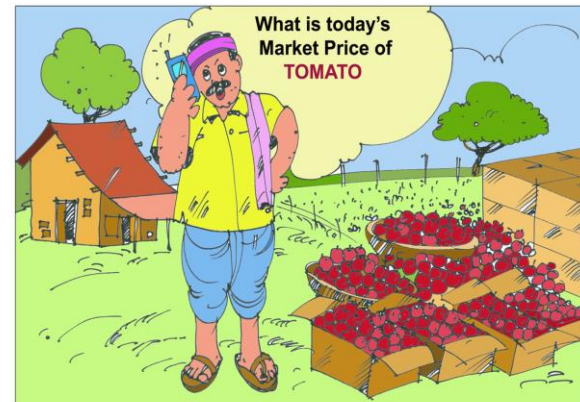
Digital Technologies: Demonstrations of Kisan Drone

- 2079 **Demonstration organized by KVKs/ECAR Institutes/AUs**

- **Area covered :** 2943.9 ha

- Activity: spraying of insecticides and nutrients using Kisan Drones.

Space Applications in Agriculture

➢ **Crop and Land use Planning, Soil and Water Conservation and Mapping for crops**

➢ **Satellite sensors provide valuable database for suitable decisions in maintaining productive capabilities of agro-ecosystems**

➢ **Surveillance of pests and diseases in crops**

Applications in Agriculture
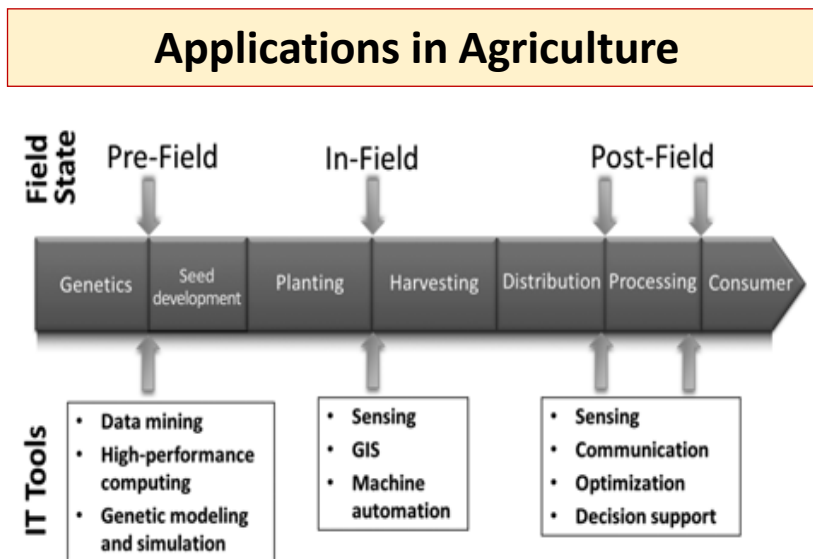
CHAMAN – FASAL : Mahalanobis National Crop Forecast Centre

Geospatial Information for Survey, Monitoring and Projections

Agricultural Experts Information System

Need for AEIS

- *Dedicated Database for Agricultural research sector*
- *Quick and ease of use in creating committee (confidential and non confidential) and taskforce*
- *Quick and efficient filter for selection of experts*
- *AEIS portal provides platform to identify and communicate with potential collaborators for research projects across geography*

- *Dedicated platform for Agriculture subject matter expert*
- *Verified user profile from multiple sources*
- *Nested filter option for filtering profiles*
- *Provision to create committee and taskforce with Logs*
- *Provision to upload ToR and Proceedings*

Link: https://aeis.icar.gov.in

Robust search function for selection of experts

Provision to create committee and taskforce

Registration of subject matter expert/ faculties/ scientists

Store ToR and proceedings

Modules under AEIS
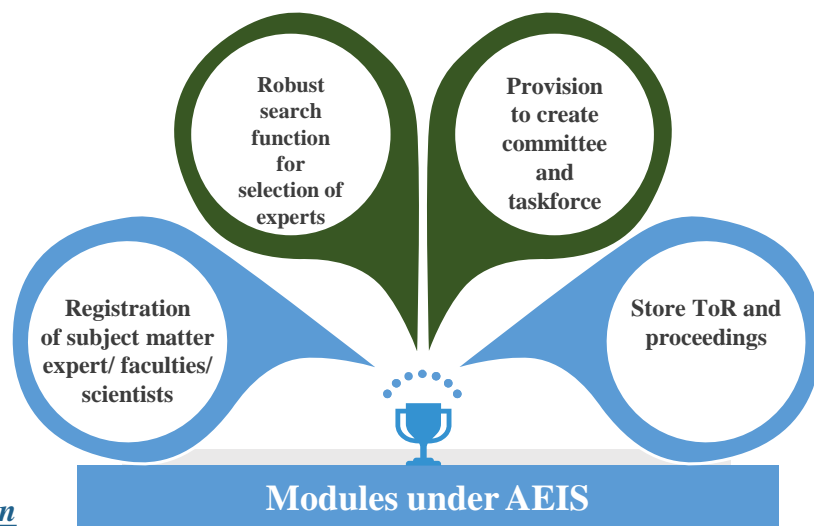
Digital Knowledge Resources (IASRI)

https://www.icar.org.in/content/technologies-and-knowledge-resources

- National Initiative on Climate Resilient Agriculture (NICRA)
- Design of Micro Irrigation Systems (DOMIS)
- Rice Knowledge Management Portal
- edalhan gyan manch
- Knowledge Innovation Repository of Agriculture in the North East
- Rohu Database
- Expert System for Maize
- Expert System on Wheat Crop Management
- Expert System on Seed Spices
- CaneInfo
- Technologies & Products for Commercialization -Animal Science
- Design Resources
- Statistical Computing for NARS
- Compendiums
- Compendium of Agricultural Technologies
- State-specific Technological Interventions for Higher Agricultural Growth
- Agricultural Transformation through Public-Private Partnership: An Interface
- Selected Agricultural technologies - A Compendium

KISAN SARATHI
Powered By IIDS

System of Agri-information Resources Auto-transmission and Technology Hub Interface

Toll free: 1800-123-2175 / 14426
https://kisansarathi.in

PLATFORM FEATURES

- Personalized 'Advisory' Based on 'Farm and Farmers' Profile'.
- 'Live Interaction' in Local Language with Domain Experts
- 'Anywhere Anytime Access' on Past Advisories
- Dashboard & MIS for Monitoring and Evaluation
- Call Facilities – Call on Mobile, Click to Call, Call Conferencing, Call Recording
- Access to Knowledge & Farmer Database – Know Your Farmer (KYF)
- 'Push Alert Message' based on 'Location and Domain'
- Facility to Register through Toll Free and Web

KISAN SARATHI — Powered By IIDS

IVRS / Toll free Number — SMS Gateway — Web Application

It is an ICT based platform for two-way multi-lingual communication system between Farmers and Agricultural Experts for transmission of agricultural technology/information and advisory in the form of Text, Images, Audios and Videos.

Present Status

Registered Farmer	: 18,06,552
Registered KVK	: 263
Agricultural Scientist	: 1,097 Number of Villages : 40,477
Total Calls	: 45,712
SMS	: 98,91,525

IT enabled service

- **Use of Digital Platform for conducting examination to third party**

- **Recruitment for other organizations/ conducting mock test**

- **Providing technical services through Apps and social medias**

AU-ACADEMIC MANAGEMENT SYSTEM (AU-AMS)
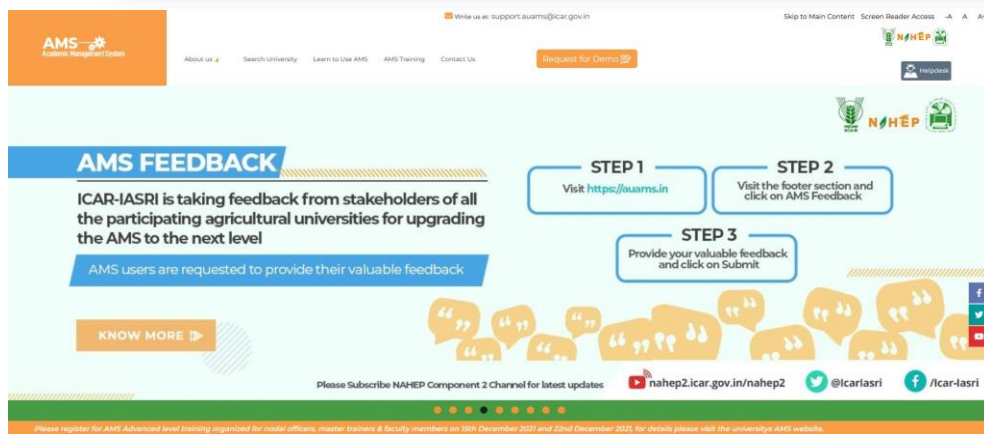
"AMS is a web enabled system for management of all academic and administrative activities of the university"

At present, the system is linked with **60** universities and **684** colleges/campuses, encompassing a total of over **6,9000+** students and **12,000+** faculty members.

Features

Transparency

User Friendly

Robustness

Efficient

Facilitates Automation

Easy to Customize

E- learning, Student, Admn, Faculty and Course management

Agri-DIKSHA Agri Web Education Channel

"An Agri-DIKSHA, is a system that provides the same opportunities for the teaching and learning process, beyond the physical limits of the traditional classroom's walls"

Agri-DIKSHA

The virtual classroom facility is bundled with Agri-DIKSHA web channel which is an interactive portal for facilitating teachers to develop and broadcast virtual learning modules.

Virtual classrooms will be part of the **'blended learning'** method that combines on-line and in-person teaching/learning wherein quizzes, video lectures and other learning material can be embedded in virtual learning modules. It combines entrepreneurial pedagogy, collaborative teaching and the latest technological teaching tools to create a modern and effective education service environment in education setting.

Features of Agri-DIKSHA

- ✔ High quality virtual learning modules
- ✔ Quick access to video repository
- ✔ Geographic, temporal and platform independence
- ✔ Online assessments
- ✔ Easy and seamless integration capabilities
- ✔ Security and data privacy

- ✔ Lectures delivered through video capture
- ✔ Any time access of lectures
- ✔ Live interaction / interactive learning experience
- ✔ Quizzes and polls functionality
- ✔ Personalized, inclusive learning experiences
- ✔ Intelligent search mechanism

▪ 18 Virtual Classrooms were established in AUs under NAHEP -Component 2 Investment in ICAR Leadership in Agricultural Higher Education
▪ 58 Virtual Classrooms have been established in AUs under NAHEP - RAES

Dashboard

74 Universities

1992 Videos in Public Library
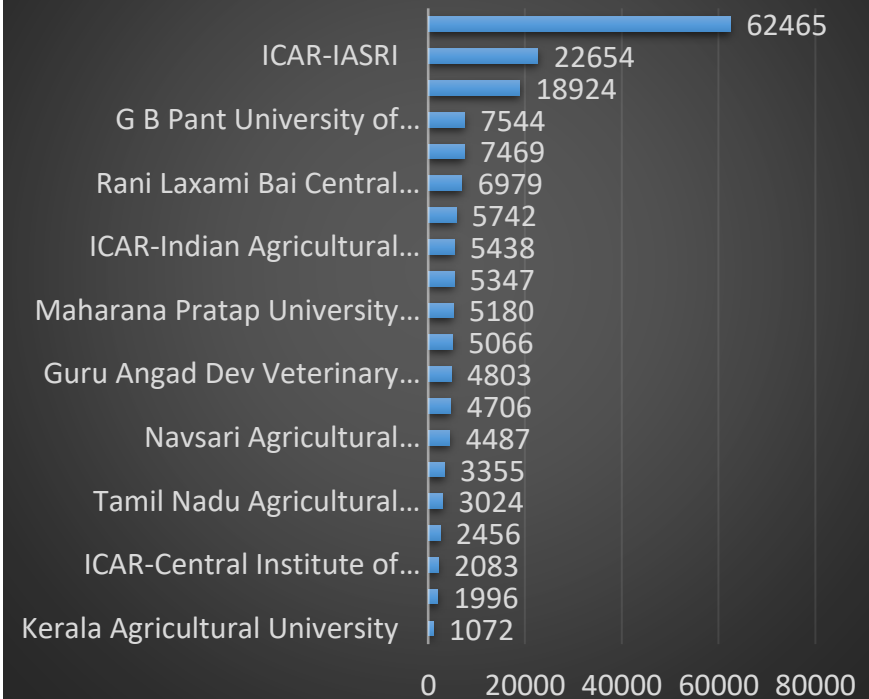
4329 Total Videos Created

3375 Total Duration (in Hours)

Agri-DIKSHA Agri Web Education Channel

Support Required

- **Universities to manage the pre-requisite infrastructure for Virtual Classroom such as sufficient internet connectivity, proper lighting and power backup**

- **Master Trainers/Faculties to attend upcoming capacity-building sessions**

- **Universities must record 4 hours of good-quality content daily and encourage students to utilize the central content repository**

- **Faculty to follow given guidelines for recording quality and effective video lectures**

Top Content Created by AUs(In Minutes)

| University	Minutes
	62465
ICAR-IASRI	22654
	18924
G B Pant University of…	7544
	7469
Rani Laxami Bai Central…	6979
	5742
ICAR-Indian Agricultural…	5438
	5347
Maharana Pratap University…	5180
	5066
Guru Angad Dev Veterinary…	4803
	4706
Navsari Agricultural…	4487
	3355
Tamil Nadu Agricultural…	3024
	2456
ICAR-Central Institute of…	2083
	1996
Kerala Agricultural University	1072

NARES – Blended Learning Platform

"Blended learning platform has been visualized as a learning platform that is aimed at enriching the teaching-learning and monitoring process across AUs in India"

Key Features
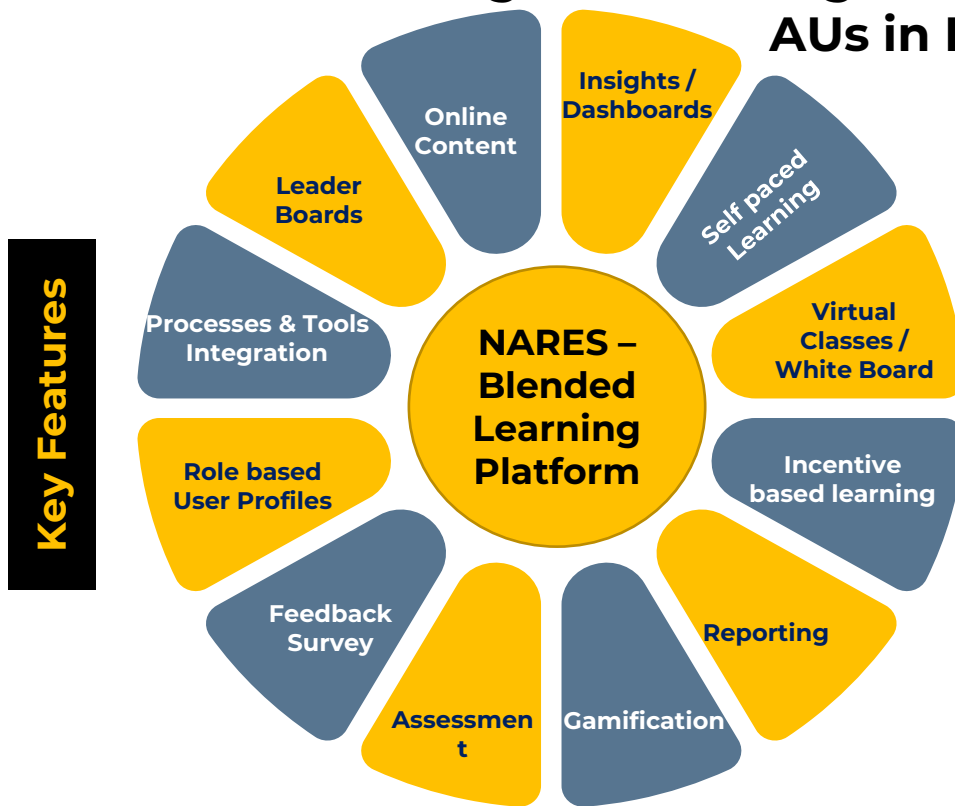
- **Fully customizable tenant** on the blended learning platform for **all Agricultural Universities**
- Platform will support **synchronous and asynchronous** learning
- BLP would support:
  - **Online Digital Learning**
  - **Massive Online Open Course**
  - **Formative, Summative, Adaptive and Gamified Assessments**
- Platform would enable a **host of micro-services through plugin API's**
- Platform would enable faculty to upload **engaging, relevant and impactful content including integration with VR modules**

Krishikosh: A Digital Repository of NARES

https://krishikosh.egranth.ac.in/
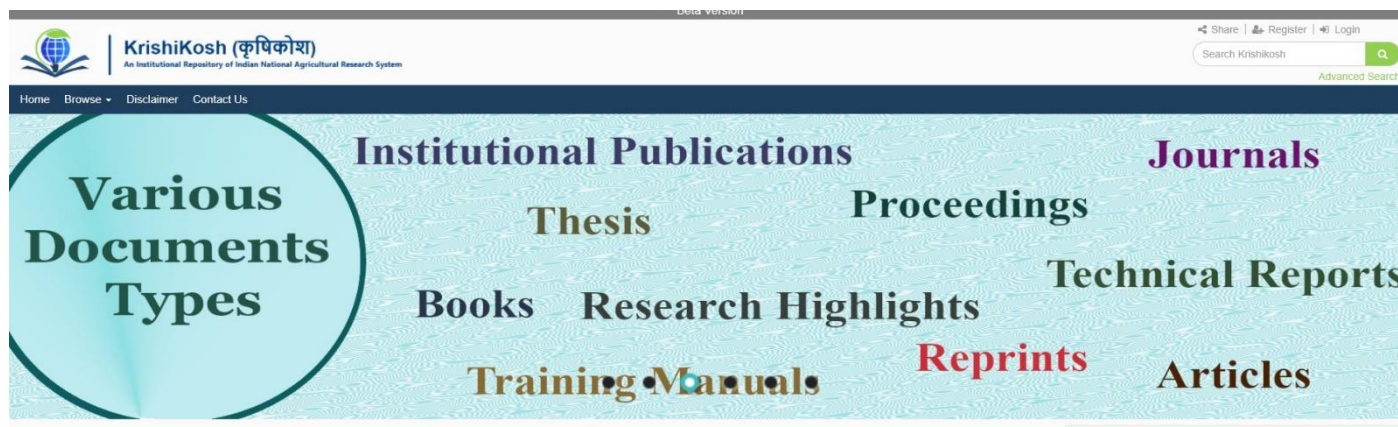
▪ Krishikosh - Digital repository of accumulated knowledge in agriculture and allied sciences available in different ICAR and SAUs

▪ Krishikosh houses 181677 Thesis; 17706 Journals; 16482 Articles; 10722 Other Documents and 2247 reports

https://krishi.icar.gov.in

- Agricultural Knowledge Resources and Information System Hub for Innovations (KRISHI)

- ICAR initiative to bring its knowledge resources to all stakeholders at one place.

- Portal is a centralized data repository system consisting of Technology, Data generated through Experiments/ Surveys/ Observational studies, Geospatial data, Publications, Learning Resources etc.

- KRISHI conferred "Digital India Awards - 2020"

Consortium for e-Resources in Agriculture

- ICAR- Consortium for e-Resources in Agriculture (popularly known as CeRA)
- Established: Nov. 2007
- An e-Consortium of NARES Libraries : 152 Consortium members
- 24x7 online accesses of selected journals in agricultural and allied sciences
- Beneficiaries: Researchers, teachers and students, policy planners, administrators, extension specialists in NARES through IP authentication.

Seed Portal

https://seed.iihr.res.in/

- ICAR - IIHR Seed Portal Online Marketplace for Improved Seed Varieties

Knowledge Innovation Repository of Agriculture in the North East (KIRAN)

- Knowledge Innovation Repository of Agriculture in the North East (KIRAN)

- User platform instrumental in harnessing the power of scientific knowledge and technology innovation for strengthening agricultural production systems in NE Region.

http://www.kiran.nic.in/

- Promote dynamic partnership and convergence among the diverse stake holders.

Krishi Vigyan Kendra Knowledge Network
कृषि विज्ञान केंद्र ज्ञान तंत्र

सत्यमेव जयते · ICAR

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https://kvk.icar.gov.in/

- Monitor various Krishi Vigyan Kendras for their activities and resource utilization

- Creating a database of the various programmes organized by the KVK

- Assisting farmers in resolving their queries using web-portal and mobile technology

- Providing relevant information to farmers such as weather and market information quickly through the portal. Also, assisting with information about various facilities and activities performed by the KVK.

- The stakeholders i.e. farmers and the Agricultural Officers can register themselves and can access relevant details about different Krishi Vigyan Kendras.

ICAR Facebook Page

https://www.facebook.com/InAgrisearch

Total Organic Followers: 2, 25, 000

Content Categories: Technologies, Events, Happenings and Govt. Schemes, Education and opportunities, R&D and Innovations, Interesting facts and figures, Shared Posts

Number of Post in last Two Years : 1109 (Technologies:319, Events:501, Others:289)

Total Page reach in last Two Years: 14, 12,2023

Post "वैज्ञानिक तरीके से ब्रोकली की खेती" received a reach of 2, 23,265 with 2250 likes

वैज्ञानिक तरीके से ब्रोकली की खेती

ब्रोकली विटामिन 'सी' युक्त गोभी वर्गीय सब्जियों के अन्तर्गत आने वाली प्रमुख फसल है, इसे सब्जी, सूप एवं सलाद के रूप में उपयोग किया जाता है।

इसकी खेती के लिए उचित जल निकास वाली जीवांश पदार्थ युक्त बलुई दोमट मृदा उपयुक्त मानी जाती है, जिसका पी.एच मान 6 से 7 के मध्य होता है।

इसकी रोपाई से 25 से 30 दिन पहले मृदा में अच्छी तरह सड़ी हुई गोबर की खाद 8 से 10 टन प्रति हैक्टर की दर से मिला दिया जाता है।

ब्रोकली में रासायनिक खाद की अनुशंसित मात्रा 120:80:60 कि.ग्रा. प्रति हैक्टर के हिसाबसे नाइट्रोजन, फॉस्फोरस एवं पोटाश का उपयोग किया जाता है।

सामान्यतः ब्रोकली 65 से 80 दिनों में कटाई के लिए तैयार हो जाती है।
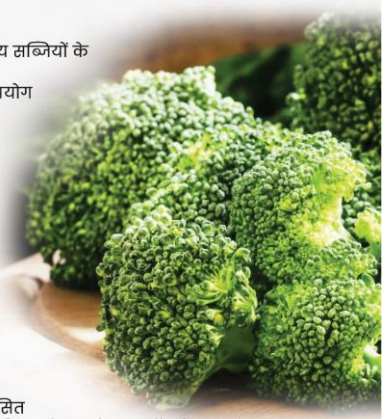
(स्रोतः फल फूल, जनवरी-फरवरी, 2023)

ICAR Twitter Handle
https://twitter.com/icarindia

Total Organic Followers: 2,06, 400
Content Categories: Technologies, Events, Happenings and Govt. Schemes, Education and opportunities, R&D and Innovations, Interesting facts and figures, Shared Posts
Total Number of Post : 6430 (Technologies:567, Events:1115 Others:4748)
Total impressions in One year days: 1,91,3100
Tweet #ICAR develops #wheat that can beat the heat . (The Indian Express : Wednesday, Feb 22, 2023) received impression 10, 493 likes 164

Indian Council of Agricultural Research. ✓
6,430 Tweets

Indian Council of Agricultural Research. ✓
@icarindia

The Official Twitter Account of ICAR, an autonomous organisation under Ministry of Agriculture & Farmers Welfare, Govt. of India. RT does not imply endorsement.

⊙ New Delhi   ⊘ icar.org.in   🗓 Joined June 2011
52 Following   206.4K Followers

Tweets   Tweets & replies   Media   Likes

Indian Council of Agricultural Research. ✓ @icarindia · 22h
खेती फरवरी 2023 #ICAR
@PMOIndia @nstomar @KailashBaytu @ShobhaBJP @PIB_India @mygovindia @AgriGoI @DDKisanChannel
Read more: icar.org.in/node/20085

खेती
फरवरी 2023

Digitalization and G20 Perspective

- **2018: Argentina**
- **Digital Infrastructure**: Broadband connectivity and data centers
- **Data Governance:** Develop framework, data privacy, data security
- **Standards & Interoperability:** Promote development of open platforms
- **Capacity building in digital agriculture**
- **Financing:** Increase investments
- **2023: India**
- **Digital agriculture and sustainable agri value chain and PPP**
- **Digital agriculture and traceability**
- **Digital tech solutions for reducing post harvest losses and waste**
- **Agri tech start up ecosystem**
- **Pluralistic agriculture extension & advisory services**

Major Challenges in adoption of digital technologies

1. Extent of profitability should be beyond of a threshold through in usage of the technology,

2. Amount of uncertainty and risk involved in adopting a technology including cost of the technology,

3. Availability and suitability of technology in the agricultural production cycle,

4. Requirement of skills and learning curve for adoption of the technology,

5. Eco-environment and digital infrastructure availability in a particular region

6. Level of agricultural production system,

7. Ease of flow of agricultural credits, and

8. Overall policy support for promotion of a technology.

Goals to achieve Agriculture Vision @ 2047

Food Security and Nutrition

India as Global Powerhouse in Food Systems

Rural and Farmers Empowerment

Sustainable Natural Resources Ecosystem

Food Security and Nutrition –Roadmap 2047

Now (Next 5 Years)

- Private players Participation – E-commerce
- Scientific & modern means of production -
- Agro ecological zone-based planning, crop clusters, Organic farming, improving productivity
- Infrastructure - modern dry storage and integrated cold chain
- Fortification, processing
- Food basket diversification
- Handholding start-ups - Agritech and exporters
- Market incentives
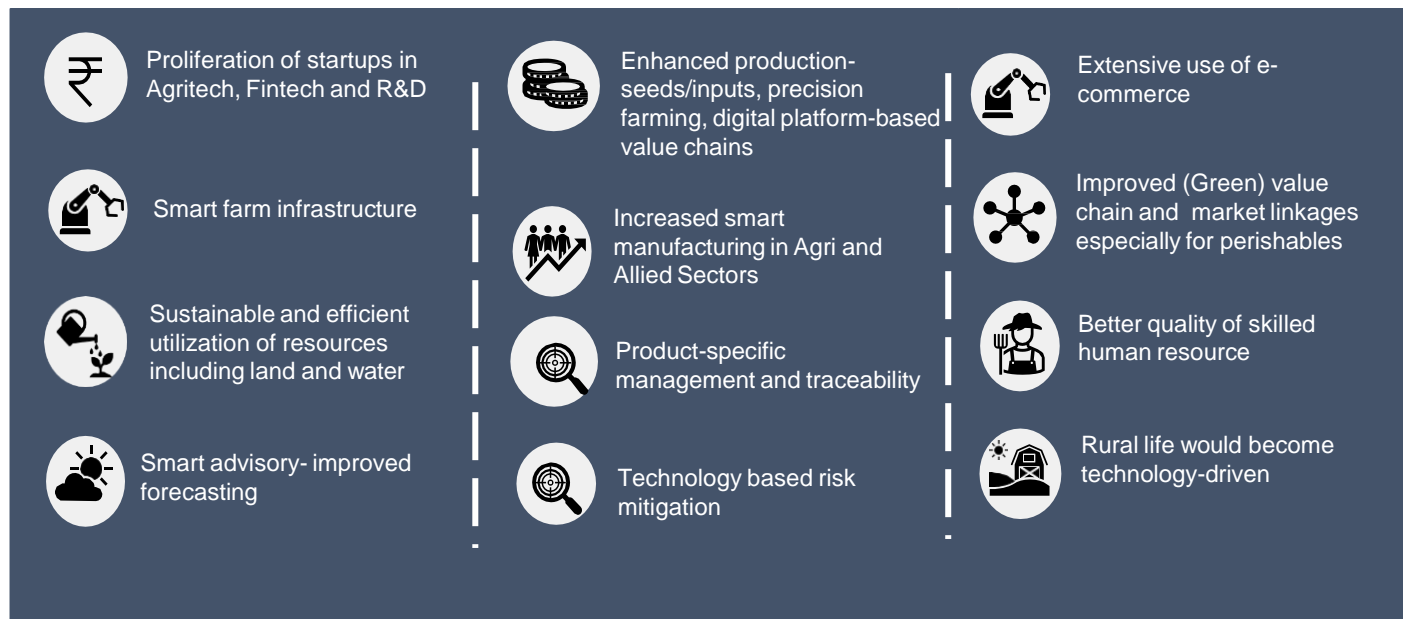- Strengthening PDS - Smaller Chains, addressing nutrition security

Next (5-15 Years)

- Precision farming, Regenerative Agriculture
- Sensor and technology-based drip irrigation
- Variable input applicators usage - real-time variability assessment; nano fertilizers
- Use of 100% Indigenous nutrients

- Systems biology approach to overcome food quality and safety issues
- New age processing technology - Frozen food, Vacuum frying and freeze-
- Technological upgradation in food delivery systems – Track and trace systems
- Survey based marketing solutions
- Instantaneous quality evaluation techniques and devices

Beyond (>15 Years)

- Shift to Enhanced Hybridization
- R&D – Now until 2047
- Development of degraded and other land
- Integration of conventional and molecular approaches
- 2X inland fisheries production
- Autonomous and advanced robotics
- Export volume and quality – processed food
- Connected and shared economy
- Supply chain optimizations

What is expected from the knowledge based digital system for Sustainable development of agriculture in general and Horticulture in particular ?

Proliferation of startups in Agritech, Fintech and R&D

Smart farm infrastructure

Sustainable and efficient utilization of resources including land and water

Smart advisory- improved forecasting

Enhanced production- seeds/inputs, precision farming, digital platform-based value chains

Increased smart manufacturing in Agri and Allied Sectors

Product-specific management and traceability

Technology based risk mitigation

Extensive use of e-commerce

Improved (Green) value chain and market linkages especially for perishables

Better quality of skilled human resource

Rural life would become technology-driven

Gaining perspectives – Attention needed on

- **Proliferation of startups in Agritech, Fintech and R&D: Smart farm infrastructure creation**

- **Sustainable and efficient utilization of resources including land and water**

- **Smart advisory- improved forecasting**

- **Enhanced production- seeds/inputs, smart farming, digital platform-based value chains**

- **Increased smart manufacturing in Agri and Allied Sectors**

- **Product-specific management and traceability**

- **Technology based risk mitigation**

- **Extensive use of e-commerce**

- **Improved (Green) value chain and market linkages especially for perishables**

- **Better quality of skilled human resource**

- **Rural life would become technology-driven**

Horticulture Vision for 2047

- **Horticulture in more potential areas**

- **Input use in potential areas**

- **Potential crop in potential area**

Forwarding looking holistic approach to address challenges and capitalize on opportunities

THANK YOU

INTERNATIONAL YEAR OF
MILLETS
2023

- **India took lead for successful implementation of International Year of Millets-2023**

- **Now the next year 2025 will be for International Year for Women in Agriculture**