

₹80/-

OCTOBER 2023

AGRICULTURE TODAY

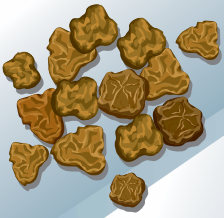
The National Agriculture Magazine

VOLUME XXVI | ISSUE 10

www.agriculturetoday.in

Horticulture AVENUE OF OPPORTUNITIES





CONTROL MOISTURE[©]

During seed drying and seed storage



◀ Bry-Air...Your Humidity Control Partner

BRY-AIR (ASIA) PVT. LTD.

21C, Sector-18, Gurugram - 122015
Haryana, India



+918826990350



1800 102 7620



bryairmarketing@pahwa.com



www.bryair.com

OVERSEAS
OFFICES

Malaysia • China • Switzerland • Brazil • Nigeria • Vietnam • Indonesia • Philippines
• Korea • Japan • UAE • Saudi Arabia • Bangladesh • USA • Canada



President
Dr. MJ Khan
Group Editor
Mrs Anjana Nair
Editor, Agri News
Sanjay Kumar

Andhra Pradesh
Satish B Gadde

Assam
Jyoti Bikash Nath

Bihar
Girendra Narayan

Gujarat
Rakesh Jani

Haryana
Bijender Singh Dalal

Himachal Pradesh
Rakesh Kumar

Karnataka
Santosh Langer

Maharashtra
Pasha Patel

Madhya Pradesh
Rakesh Dubey

Punjab
Puneet Singh Thind

Rajasthan
Parvinder S Chauhan

Telangana
Jaipal Reddy

Tamil Nadu
Raju Narasimman

Uttar Pradesh
Umesh Shukla

Uttarakhand
Narendra Mehra

Admin & IT Head - Anil Kumar

IT Manager - Ankit Kumar

Sr. Business Manager - Vinita Singh

Assistant Editor - Zaman Almas

Asst. Manager, Digi Mktg - Tanya Kalra

Web Designer - Mr Rahul Singh

Graphics - Akash Bhargav

Subscription - Mohd Aijaz

Circulation - Rajkumar

Graphic Designer

A. Rehman

STATE HEADS OF ATG BUREAUS

SUPPORT TEAM

DESIGN

Publisher & Printer – Dr. MJ Khan on behalf of M/s Concept Agrotech Consultants Limited, Published from 306 Rohit house Tolstoy Road New Delhi-110001 and printed by Everest Press E-49/8, Okhla Industrial Area-II New Delhi-110020

Phone No. 011-23731129 Fax No.011- 23731130

E-mail: editor@agriculturetoday.in

info@agriculturetoday.in

No part of this magazine can be reproduced, imitated or transmitted in any form, including electronic, mechanical, photocopying, recording or any information stage retrieval system or extracted in any way without permission from the publishers. Views expressed in the magazine need not necessarily be those of the Editor / Publisher.

www.agriculturetoday.in

Page in the magazine: 60

HORTICULTURE – CONFLUENCE OF TECHNOLOGY AND KNOWLEDGE

India's horticulture production stands at an enviable position. From being cereal centric, India's agriculture system has taken a new turn with horticulture and this renewed focus can be attributed to the identification of the segment with nutritional security, rural employment, farm diversity and enhanced farmer incomes. Today productivity of horticulture crops is much higher compared to productivity of food grains. India has emerged as world leader in the production of fruits and vegetables. Several new crops have also earned the faith of farmers. Kiwi, gherkins, kinnow, date palm and oil palm have been successfully introduced for commercial cultivation in the country.

Increased awareness about nutritional benefits of horticulture products, rising income, export demands, increasing population and exposure to newer products have created a demand in the market. However, the products are perishable and in the event of over production or under production, there is the risk of price volatility. Even though this should act as a deterrent, the country has never experienced a struggle to produce the required quantity of horticulture products. This clearly demonstrates that practicing horticulture is worth the risk.

The growth in the segment can also be attributed to the penetration of technologies. Improvement in irrigational facilities, technologies, involvement of small and marginal farmers, better agronomic practice, improved varieties of seeds, introduction of hybrids, green houses etc., have strengthened the segment and improved its profitability. More and more technology is being successfully integrated into horticulture, thereby continually raising the scope and opportunities in the segment.

Climate change and market volatility continue to haunt the segment. The recent spike in prices of tomatoes and onions are in fact pointers to our mismanagement of agriculture surplus and dearth. We need to invest in market forecast and weather forecast and offset the uncertainties through careful discerning of the market and climate variables. We should also invest in value addition and packaging and create affordable quality alternatives that can be introduced in the times of price hike. The surplus can be converted into these products and they can be reintroduced into the market which will stabilize the situation of both consumers and producers.

Challenges in horticulture are immense. But on close examination these are opportunities – opportunities to grow and adapt. By assimilating new technologies and knowledge, India is capable of ushering in a new era in horticulture, one that is sustainable, resourceful and profitable.



Anjana



From The Group Editor's Desk	03
OVERVIEW	
Floriculture & Spices: India's Sunrise Sectors	12
PERSPECTIVE	
Towards Making Agriculture a Happy Profession through Horticulture	14
CLIMATE SMART	
Cultivating Resilience: Post-Harvest Handling and Storage Strategies in a Changing Climate	16
QUALITY MATTERS	
HORTICULTURE: Farm to Fork via Quality Management	24
AGRI INFRASTRUCTURE	
Unlocking the Potential of Cold Chain Infrastructure in India	26
INNOVATION	
Natural Green House: A Game Changer	28
IN CONVERSATION	
Divya Rawat: The Mushroom Lady	30
HUMAN RESOURCE DEVELOPMENT	
Building Talent For Horticulture Development	32
DIFFERENT STROKES	
Soilless Saffron: Success in Indoor Cultivation	34
GLIMPSE	
Indian Bean: Multi-Utility Crop for Tropical Region	38
IN CONVERSATION	
Reshaping India's Agri Sector	42
SUCCESS STORY	
Rice Fields to Potato Abundance	44
DIGITAL AGRICULTURE	
Smart Farming for Sustainable Agriculture	46
TECHNOLOGY TURF	
Unveiling the Quantum Frontier in agriculture	48
FARMER COLLECTIVE	
Conservation of Agro-biodiversity and Nutrition Security	50
AGRI FINANCE	
Strength of Agri Finance	52
CROP PROTECTION	
Crop Health Management for Sustainable Agriculture	54
DIARY DOSSIER	
The Need of Hour: White Revolution-II	56

06

SKILL DEVELOPMENT

DR. T. JANAKIRAM



09

BIOAGRICULTURE

RAJESHWAR SINGH CHANDEL



18

TÊTE-À-TÊTE WITH ANJANA

RAVI GUPTA



22

STATE FOCUS

DR. ARJUN SAINI

36

SUSTAINABLE DEVELOPMENT

TUSHAR PANDEY



40

ICT IN AGRICULTURE

PADMASHRI DR. M.H. MEHTA

Chemistry

Packaging

Bio-Efficacy

We till **Concept** till Harvest

Concept Agrotech Consultants Limited

Toxicology

Bio-Efficacy

One Stop Solution for all your Regulatory Services Requirements

Data Generation | Registration | Product Services

DRS DATA AND REGULATORY SERVICES

Agrochemicals | Bio-Stimulants | Bio-Inputs

Packaging



CHEMISTRY



TOXICOLOGY



BIO-EFFICACY



RESIDUE



LEGAL



PRODUCT SERVICES

To know more, please contact

Satender Routela, Manager - DRS | Mob : +91 7290010849
Email : satender.routela@cacl.in

Visit our website

EMPOWERING WOMEN THROUGH SKILL TRAINING AND ENTREPRENEURSHIP INITIATIVE OF DR. Y.S.R. HORTICULTURAL UNIVERSITY

The horticulture sector in Andhra Pradesh is characterized by its diverse and flourishing landscape. The state's favourable agro-climatic conditions enable the cultivation of a wide range of horticultural crops, making it one of India's leading horticultural hubs. Andhra Pradesh's horticultural prowess, coupled with its focus on sustainable

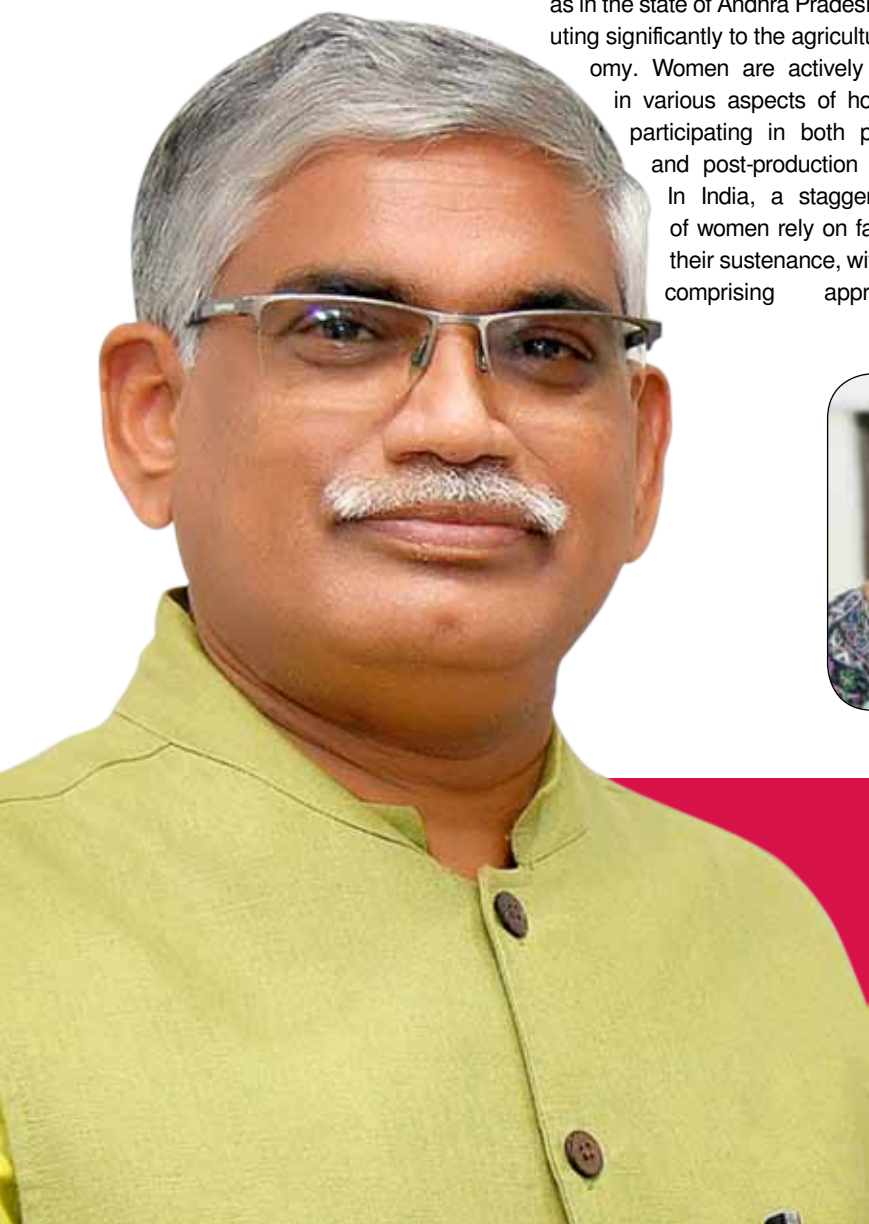
farming practices and water management, positions it as a key player in India's horticulture sector. The sector's export potential, combined with its role in ensuring food security, underlines its importance in the state's agricultural economy.

Women in Agriculture

Women play a vital and multifaceted role in the horticulture sector in India as well as in the state of Andhra Pradesh, contributing significantly to the agricultural economy. Women are actively engaged in various aspects of horticulture, participating in both production and post-production activities. In India, a staggering 84% of women rely on farming for their sustenance, with women comprising approximately

14% of all farmers and contributing to 47% of the farm labour force. Of these women, only 32.8% are formally part of the labour force, while the remaining engages in subsistence labour. Alarming, 52%-75% of women involved in farming lack formal education, and their earnings typically amount to just 70% of what men earn.

Dr. Y.S.R. Horticultural University established on June 26, 2007, by the Government of Andhra Pradesh, stands as the second of its kind in India. With a strong commitment to benefiting rural and tribal communities, particularly women and youth through horticulture, the university places a significant focus on technology transfer and extension activities. With this aspiration, Dr. Y.S.R. Horticultural University declared the year 2020-



Dr. E. Karuna Sree



Dr. K. Mayuri

About the **AUTHOR**

Dr. T. Janakiram, Vice Chancellor
Dr. E. Karuna Sree, Director of Extension, Dr YSRHU, Venkataramannagudem, Dr. K. Mayuri, TO to Director of Extension, Dr YSRHU, Venkataramannagudem, Andhra Pradesh



21 as the "Dr. YSRHU Year of Women Empowerment." Under this initiative, a series of webinars and programs were conducted, aimed specifically at women. These events addressed various aspects of women's empowerment, including nutrition, economic opportunities, entrepreneurship, social empowerment through Self Help Groups (SHGs), and the promotion of nutri-sensitive agriculture.

Enhancing the Skill Set

Recognizing that providing the right skills to the right people is crucial for sustainable employment development in rural and tribal areas, the university established the Processing and Horticultural Skill Training Centre at KVKs. This initiative offers skill training programs, particularly to women in following key areas of Horticulture.

Dry Flower Technology

Women from rural and tribal backgrounds received training in preserving flowers using methods such as pressing, drying, and dehydration. Tirumala Tirupati Dev-

Empowerment, as an active process, has enabled women to realize their full potential and identity, making them agents of positive change in their lives and communities.

astanams (TTD) and Dr.YSR Horticultural University (Dr.YSRHU) have agreed to coordinate to develop multi uses and value addition to worshipped flowers by establishing "Training Centre for Making Value Addition to Worshipped Flowers" at Dr.YSRHU- Citrus Research Station, Tirupati, Chittoor district by providing hands on training to women & youth for creating value addition to worshipped flowers. The ultimate goal of the project articulated in this MoU shall only be better way utilization of worshipped flowers and production of value-added products from worshipped flowers. The Training centre has prepared about 16,738 images worth Rs. 71,19,756/- and created

employment to about 160 women trainees under this project.

Scientific Beekeeping

Rural women are being trained in production of bee hive boxes and multiplication of Bee hive colonies was taken up as revenue generation activity and so far about 250 bee hives and bee colonies were multiplied and supplied earning a revenue of Rs. 12,50,000.00.





Nursery Management in Horticultural Crops

Training in the production of improved fruit crop varieties, grafting techniques, and propagation of ornamental and flower crops was provided to about 86 rural and tribal women.

Mushroom Production Technology

Practical training in oyster and milky mushroom cultivation was offered, enabling year-round mushroom production. This training, conducted in partnership with ATMA, helped trainees establish mushroom cultivation ventures.

Production of Bio-Control Agents

Recognizing the importance of organic farming practices, the university provided training to about 128 women trainees in the production and mass multiplication of bio-control agents, contributing to the adoption of organic cultivation in the region.

Fruit and Vegetable Processing

Training programs for women focused on processing and value addition of fruits and vegetables, reducing waste and improving nutritional access. Processed products, marketed under the "Dr. YSRHU foods" brand, offered economic opportunities. Krishi Udyana Mahila Utpathidarula Sahakara Sangham was established to market these products.



In India, a staggering 84% of women rely on farming for their sustenance, with women comprising approximately 14% of all farmers and contributing to 47% of the farm labour force.

Millet Processing and Value Addition

Training in millet processing and value addition aimed to promote the use of millets in daily diets. This initiative led to the establishment of about ten millet-based enterprises, addressing both nutrition and income generation.

Integrated Farming Systems

Integrated fish farming, combining fish culture with horticulture and livestock production, was introduced to 40 tribal women. This sustainable model significantly increased family income and nutritional security.

Backyard Poultry Integrated with Horticulture

Poultry farming in plantations and orchards provided supplementary employment opportunities and nutritional security for rural and tribal communities, particularly women. The backyard poultry

system played a crucial role in providing affordable protein sources.

Rubber Processing

Training in rubber tapping and processing enabled women to establish processing units, producing marketable rubber products. This initiative significantly boosted their income and livelihoods.

Bamboo value added products

Dr YSRHU-KVK, Venkataramannagudem organized 90 days skill training to 20 tribal women in Bamboo value addition to impart the skill to tribal women in preparing 21 varieties of products with bamboo. Further, motivated the trainees to form a Common Interest Group in the name of GIRI SRUJANA to take up this activity. The impact of these skill interventions was profound. Several women received recognition and awards for their outstanding contributions to Horticulture and entrepreneurship. These achievements underscored the transformative power of skill training and empowerment initiatives. By imparting essential skills and fostering entrepreneurship, the university has not only improved livelihoods but also contributed to the overall development of these communities. Empowerment, as an active process, has enabled women to realize their full potential and identity, making them agents of positive change in their lives and communities.

CETARA-NF

SUSTAINING SMALLHOLDERS' FARMING

The Government of Himachal Pradesh is working on a mission of climate-resilient and chemical-free farming known as natural farming, or Prakritik Kheti Khushaal Kisan Yojana (PK3Y), to empower smallholder farmers and promote agroecology-based production by promoting natural farming practices. Dr YS Parmar University of Horticulture and Forestry has been the key partner to this flagship initiative. Natural Farming as propounded by Padmashri awardee Sh. Subhash Palekar and further popularized by Acharya Devvrat, the Governor of Gujarat is the way forward for sustainable agri food systems to progress.

Certified Evaluation Tool for Agriculture Resource Analysis in Natural Farming

The United Nations has recognized globally that all forms of agroecology are the way forward for future global sustainability, carbon sequestration, climate change and achieving Sustainable Development Goals (SDGs). Natural farming also called as ZBNF or SPNF in its optimal sense is the closest to applied agroecology. This ambitious program has been further supported by the establishment of the Sustainable Food Systems Platform for Natural Farming (SuSPNF). However, the rugged topography of this Himalayan province posed a significant challenge in certifying natural farming produce. To ad-

At the core of CETARA-NF lies a commitment to simplicity, sustainability, traceability, and transparency.

dress this challenge, a self-certification system was introduced, giving rise to the Certified Evaluation Tool for Agriculture Resource Analysis in Natural Farming (CETARA-NF). Today, CETARA-NF has garnered participation from around 70,000 farmers, revolutionizing the certification landscape.

At the core of CETARA-NF lies a commitment to simplicity, sustainability, traceability, and transparency. It is designed to be farmer-friendly, ensuring that both farmers and implementing agencies can easily comprehend and utilize the system. Key principles, including

the prohibition of agrochemicals, external inputs, and GMOs, align with the principles of a localized natural farming system, emphasizing sustainable and chemical-free agricultural practices.

Natural Farming Practices

The four wheels of natural farming practices such as Beejamrit (Seed Treatment), Jeevamrit (Inoculation), Achhaddan (Mulching), and Waaphasa (Soil Aeration) are fundamental components of the evaluation. Farmers are encouraged to adopt all of these



About the AUTHOR

Rajeshwar Singh Chandel,
Vice-Chancellor and Rohit
Vashishat, Research Scholar, Dr YS
Parmar University of Horticulture
and Forestry, Himachal Pradesh

practices to achieve higher ratings. Intercropping and crop rotation receive significant recognition within the certification system due to their positive impacts on functional diversity, soil health, and cost-effectiveness in farming. Farmers who own indigenous cows are rewarded positive impact on rating, as these animals play a central role in natural farming practices, contributing to sustainable agriculture.

Why do we need a CETARA NF Certification system?

It is also debatable why we need CETARA- NF, if the PGS organic (Participatory Guarantee System) is also available? PGS organic certification is based on peer-to-peer verification and relies heavily on farmer groups. It involves a network of farmers, consumers and local certifying bodies that collectively assess and certify organic farms. PGS organic typically include some fee of membership, application, inspection, certification, renewal, training, testing and administrative fees, supporting organic farming practices which increase the cost of production of farmers. Hence it becomes very difficult for the farmers to access all the networks and availability of all stakes in his region, especially in case of Himalayan mountainous states like Himachal Pradesh. Thus, the foundation of CETARA-NF was laid considering points like localized, agroecological, chemical free farming practice, easy to assess, transparency, traceability, access to markets, social and environment welfare.

CETARA-NF incorporates an online comprehensive grading and rating system which classifies farmers, into three distinct levels based on their commitment to natural farming practices: Antral kisan (Entry Level), Sadharan kisan (Intermediate Level) and Vishisht (Advanced Level). This system encourages farmers to transition towards natural farming, with a transparent and decentralized evaluation process. CETARA-NF offers multi-tiered market access, with centralized branding and accessibility nodes for various stakeholders. It seamlessly integrates with

How Does it Work? - Locally Done Globally Available Online



Please Scan the Code from your Phones



Farmers Use QR Code on Produce/Products



CETARA-NF offers a unique and accessible certification system, setting it apart from existing models.

existing regulatory systems and market identities, ensuring compliance and complementarity rather than competition. PGS organic does not provide these innovative marketing facilities to farmers.

The Innovative Evaluation Methodology

It empowers farmers with rankings that unlock preferential market access, payments for agroecosystem services, and other benefits, ultimately enhancing the

livelihoods of smallholder farmers. CETARA-NF has emerged as a transformative force in the agroecological landscape of Himachal Pradesh. It introduces an innovative evaluation methodology that simplifies the process for farmers and implementing agencies.

Key principles include a prohibition on agrochemicals and GMOs, adherence to natural farming practices, scalability with farmer producer companies (FPCs) and individual farmers' schemes. This methodology encompasses a tiered classification system that offers farmers a clear and accessible path to establishing their production level. Moreover, it seamlessly aligns with existing certification mechanisms like peer review from minimum three neighbour farmers because practices of natural farming are chemical free and products are purely organic/natural.



The CETARA-NF digital evaluation system is at the heart of this innovative certification methodology, and it is designed with several key features that enhance its effectiveness in mapping agroecology.

Scoring in CETARA- NF

CETARA- NF does not restrict any farmer to enter in certification process. Farmer put their response and it leads to assigning scores on their farm practices. Those who employ natural products, and foster eco-friendly practices will get positive score. Conversely, negative scores are assigned when chemical fertilizers and external pesticides are detected, discouraging harmful agricultural practices. This certification methodology underwent rigorous testing on 1500 farmers, resulting in a well-structured scoring system that fairly classifies farmers into different star ratings based on their adherence to SPNF practices. CETARA-NF offers a unique and accessible certification system, setting it apart from existing models. It empowers farmers to engage in self-certification, streamlining the process for newcomers and ensuring prompt certification issuance. Individual farmers can also seek certification, accommodating diverse farming scales and practices. Peer review adds credibility by involving both peer farmers and nodal officers in

the certification process.

Impacts of CETARA Certification

Within the CETARA-NF certification framework, a star rating system has been integrated to provide consumers with a straightforward means of recognizing the commitment of farmers to natural farming practices. As of the latest available statistics, CETARA-NF has successfully certified a substantial number of farmers, totaling 69,225 individuals. These certified farmers consist of 22,098 male farmers and 47,127 female farmers, collectively contributing to the promotion of sustainable and eco-friendly agriculture in Himachal Pradesh. A commendable 3,688 farmers have achieved the prestigious 3-star rating. The majority of CETARA-NF certified farmers, numbering 45,490, hold a respectable 2-star rating. Additionally, 20,047 farmers have received a 1-star rating, signifying their initial steps toward embracing natural farming practices.

These star ratings not only empower consumers to make informed choices but also recognize and incentivize farmers at different stages of their natural farming journey.

Ensuring Transparency

CETARA-NF offers free access to an on-

line portal (Managed by the Gram Disha Trust) that is changing the game for rural agriculture. Central to this initiative is the generation of QR traceability codes, each representing a farmer's commitment to chemical-free cultivation practices. These QR codes, validated by peers and verified by extension officers, carry star ratings, signifying the farm's self-reliance and sustainability. CETARA-NF is a shining example of a collaborative, participatory innovation that involves the government, farmers and consumers in reshaping local food systems. It inspires similar initiatives, all working towards a sustainable future in agriculture, where everyone, from farmers to consumers, emerges as a winner.

CETARA-NF stands as a beacon of agricultural transformation in Himachal Pradesh, offering farmers a clear path to embrace natural farming practices and reap the associated benefits. This innovative certification system not only empowers farmers but also enhances transparency and sustainability in the agricultural supply chain. As the program continues to grow and evolve, CETARA-NF exemplifies the potential of decentralized, farmer-centric approaches to drive positive change in agriculture, setting a remarkable example for the world to follow.

FLORICULTURE & SPICES

India's Sunrise Sectors

Floriculture is a high growth, sunrise Industry in India. With changing life styles and increased urban influence, floriculture has assumed a definite commercial status in the past 2-3 decades. The domestic consumption of flower products has increased considerably. Exports not only of the cut-flowers but also of several value-added products such as dry flowers, potted plants, etc have gone up visibly. Environment conservation and the concerns being raised globally on protecting the planet earth and the city dwellers' concern about having quality/fresh air in daily life provided useful fillip to landscape gardening, town planning and use of plants for aesthetic purposes

Production and Potential

About 283000 ha were under cultivation for floriculture in 2021-22 (3rd Advance Estimate). Production of flowers is estimated to be 2295.07 thousand tonnes of loose flowers and 833.16 thousand tonnes of cut flowers in 2021-22 (3rd Advance Estimate). The country has exported 21024.41 MT of floriculture products worth Rs. 707.81 Crores in 2022-23. U.S.A, Netherlands, UAE, U.K. Germany and Malaysia were major importing countries of Indian floriculture during the same period.

Apart from loose flower production, the sector offers immense potential in pot plant production, plug plant production, production of lawn grasses, production of landscaping plants, topiaries, trees, vertical gardens and tree transplantation etc.,



At the core of CETARA-NF lies a commitment to simplicity, sustainability, traceability, and transparency.

Value Addition

Value addition, is another area, in terms of extraction of essential oils, pigments, natural dyes, dry flowers etc.

Dry flowers:

Majority of exports in floriculture from India are in dry flowers category. The most promising area in floriculture is the dry flower industry. Dried flowers and plants have been exported for the last 40 years and today, India is one of the leading countries in the field. Export of dried flowers and plants from India is more than Rs. 350 Crore per year. Potpourris are

the major segment of dry flower industry valued at Rs. 55 Crore in India alone. The export market of flowers in India is composed of 71% of dry flowers exported mainly to U.S.A, Japan, Australia, Europe and Russia. Exporting companies at Kolkata in West Bengal, Tuticorin in Tamil Nadu, Mumbai in Maharashtra and Hyderabad in Andhra Pradesh are earning 10-15 times higher returns than domestic markets. India, with its vast resources, varied products and experience in the field of dried flowers and plants enjoy a distinct advantage.



About the AUTHOR

Dr Sudhakar Pandey, Assistant Director General (Flowers, Vegetables, Spices and Medicinal Plants), Horticultural Science Division, Indian Council of Agricultural Research, New Delhi

Essential Oils

The world's total production of essential oils (Including other crops) is estimated at about 100000 – 110000 tonnes, and India stands third with a share of 16- 17%. In value terms again, India's position is No. 2 and its share is 21- 22%.

Natural Dyes, Pigments and Nutraceuticals

Lutein is extracted by several private players for extraction and export of lutein from marigold. Lutein is utilized by poultry Industry for improving colour of egg yolk and broiler skin. These extracts are also in demand from pharma Industry as nutraceuticals. AICRP on Floriculture, BCKV Kalyani centre has developed technology for preparation of marigold fermented powder that can be utilized by poultry industry.

Organic Farming in Spices

Presently the country has 5.71 million hectares of land under organic production under various streams of certification, and the NPOP certification programme presently covers 3.7 million hectares in the country. Out of the total organic certified production of 2.9 million tonnes in India, spices and condiments accounted for 57379 tonnes (2019-20), of which 8053 tonnes are exported. Organic horticultural products export constituted 6-8% of total organic export of India of which organic spices constitute barely 2% now. Organic spices exports have been growing rapidly in recent years, recorded 25 percent increase in quantity, and 11 percent increase in value. The main organic spices traded by volume are pepper (39%), ginger (19%), turmeric (11%), cardamom (8%), chilli (7%), cloves (7%), nutmeg (7%), and others (7%). The current market size is small but demand is expected to grow at a rate of 15% in the coming decade.

Most of the non-traditional areas and NE states are having larger area under black pepper, ginger, turmeric, garcinia and chillies cultivation without or minimal application of chemical inputs. These areas are very much suitable for organic conversion enabling the region to become the "organic spices hub". The North East-

Research Areas in Floriculture

- Long-term pre-breeding and genetic enhancement for quality and biotic traits
- Development of trait specific varieties as per market demand
- Micro-propagation and production of quality planting material
- Development of low cost and region-specific production technologies for protected and outdoor environment.
- Diagnostics and development of IPM and IDM modules for important crops
- Post-harvest management and value addition (essential oils and natural colors).
- Development of tools and gadgets to promote mechanization
- Use of new breeding techniques i.e., gene editing for specific quality traits



ern States are the major belt of ginger and turmeric production in our country which contributes 37.4%. Sikkim has been declared organic state which annually produces 48,000 and 2900 tonnes of organic ginger and turmeric, respectively and contributes 87% of large cardamom production of India to the world market. Given the ever-growing shift towards chemical-free organic food items in western world, the potential for export of organic commodities is high, and India is placed at an advantageous position being a major exporter to the global market.

Global Potential

The research institutions like ICAR-IISR, ICAR-NRCSS, AICRP on Spices, SAUs and ICRI (Spices Board) have developed package of practices for organic production of clean and food-safe spices for major spice crops. As spices are major sources of nutraceutical compounds and with global demand for functional foods

picking up, India could emerge as a major player by exploiting its own strength in self-sustaining organic systems with the adoption of these green technologies.

The traceability of spices products is emerging as a key requirement in the modern consumer driven market. Assured buy back guaranteed marketing opportunities can enable primary producers to focus on organic production activities without worrying about marketing of the produce. The organic spice economy is critically dependent on export markets for realizing higher unit value for the produce. Efforts for diversification of export destinations at the global level and deepening of domestic market for organic spices are important for sustainable development of this niche sector.

Pertinent Areas of Research in Spices

There are several areas of research in spices which need to be geared up to fully exploit its global potential. Demand driven varietal improvement; Evolving stress tolerant lines; Generation of eco-region and site-specific precision technologies; Developing spices based organic farming packages; Biotic stress management; Development of post-harvest technologies; Enhancing productivity of spices through mass multiplication of quality planting material and distribution; Participatory approach for effective transfer of technologies, supply chain models to empower stakeholders, Impact assessment for further refinement and Geo-tagging of spices are some areas where research should be focused on.



TOWARDS MAKING AGRICULTURE A HAPPY PROFESSION THROUGH HORTICULTURE

Agriculture, an ancient profession, has faced significant challenges due to lack of streamlined processes in various aspects of the ecosystem. Unmitigated risks due to agroclimatic conditions resulting in fluctuation in product prices and economic uncertainty have made agriculture an unattractive option for many.

Furthermore, a multitude of factors contribute to the hesitance among younger generations to engage in farming. Limited access to essential resources, the ever-changing dynamics of agricultural markets, lack of awareness of technological solutions, adverse effects of climate shifts, and fragmented land holdings have created barriers to entry. The physically demanding nature of farm work, the dearth of educational opportunities in rural settings, and



About the AUTHOR
Mr. Senthilnathan Sengottuvelu,
Chairman & Managing Director,
ACSEN Agriscience Pvt. Ltd.

the allure of urban life with its perceived economic prospects have further deterred the youth from embracing agriculture.

Realizing the potential of Horticulture

Amid formidable challenges plaguing the agricultural landscape, horticulture emerges as a beacon of promise and opportunity. Horticultural crops, including fruits, vegetables, medicinal plants, herbs, and ornamental plants, offer a range of distinctive advantages that make them stand out in the farming domain.

Foremost among these advantages is the potential for higher profit margins. Horticultural produce, particularly fresh fruits and vegetables, often commands premium prices in the market, translating into increased income for farmers. This economic appeal is complemented by



processes that offer enhanced production capabilities. With improved crop yields coupled with high-quality produce, farmers stand to enjoy increased profitability and economic stability.

The positive ripple effect of these advancements extends to consumers as well. They can expect to enjoy the fruits of this labour in the form of tasty and nutritious food. The improved quality of horticultural produce resulting from these resilient seeds ensures that consumers receive the best in terms of flavour and health benefits.

Processors within the agricultural supply chain also stand to gain from these developments. The seeds' attributes, such as better shelf life and transportability, make it easier for processors to procure raw materials efficiently. Additionally, the extended window for sowing and harvesting promises a more extended period of availability across a broader geographical range, allowing processors to meet market demands more effectively.

TransFARMING the ACSEN Way

At ACSEN Agriscience, we're driven by our mission: "More Profit per Acre, for More and More Farmers, Year after Year". This commitment fuels our efforts to empower farmers with high-quality, nutrient-rich, climate-resilient, and pest-resistant seeds, transforming horticulture into a profitable and sustainable profession. We prioritize open-pollinated seeds to assist marginalized farmers by offering high-quality open-pollinated varieties, leading to better yields and adaptation to local conditions. This approach enhances productivity and sustainability for farmers with limited resources.

We take pride in ranking 5th in the World Benchmark Alliance's Access to Seed Index for South and Southeast Asia. As we expand across regions like Bangladesh, Sri Lanka, the Middle East, and Africa through our brand, HyVeg, we're dedicated to addressing global food security sustainably, ensuring a brighter future for the next generation of farmers.

We envision agriculture regaining its appeal and attracting new, passionate talent, ultimately becoming a sought-after profession like any other.

In an era marked by unpredictable climate patterns, seeds designed for resilience offer a lifeline, allowing farmers to withstand the challenges.

How the Seed industry supports the changing ecosystem

Within the vast landscape of agriculture, the seed industry stands as a cornerstone, wielding significant influence in the pursuit of food security and the prosperity of farmers. This pivotal role is defined by the provision of high-quality seeds meticulously designed to cater to the unique demands of horticulture. These seeds are packaged with traits such as nutrient-rich content, climate resilience, resistance to pests and emerge as potent tools in developing a profitable and sustainable horticultural landscape.

In an era marked by unpredictable climate patterns, seeds designed for resilience offer a lifeline, allowing farmers to withstand the challenges. The seed industry contributes to water conservation efforts by providing seeds that are Water use efficient (WUE), addressing a critical issue in agriculture. The seed industry is committed to providing quality seeds as per guidelines and battle the perils of counterfeit seeds safeguarding the interest of farmers. In sum, the seed industry empowers farmers, promotes sustainability, and plays a vital role in ensuring food security for the growing global population, charting a path toward a prosperous and sustainable future.

Horticulture's Impact on the Global Food Supply

The advancements in seed technology brings a new promise to farmers. Growers can look forward to streamlined cultivation

diversified income streams. Unlike traditional subsistence farming that relies on a single crop or livestock, horticultural farmers can cultivate a variety of crops throughout the year. This diversification not only spreads risk but also ensures a consistent income flow due to staggered harvest periods.

Furthermore, horticulture stands out as a resource-efficient practice. It requires less land compared to field crops or livestock farming, making it suitable for areas with limited space. Horticultural crops are favored for their higher yield and better fruit-bearing capacity, contributing to enhanced profitability per acre.

Capitalizing on Ecosystem Improvements

In recent years, horticulture has increasingly captured the preference of farmers due to several changes in the ecosystem. This shift is supported by the ease of cultivation, increased resource efficiency, opportunity to adopt multiple cropping and sustainable farming solutions and better rate of returns. Simultaneously, enhanced transportation infrastructure has expanded market access for horticultural produce, empowering farmers to reach broader consumer bases. Government initiatives and subsidies, such as clustered farming and "one district one crop," have provided incentives for horticultural ventures. The growth of digital platforms and online marketplaces have streamlined the distribution chain, enabling direct farmer-consumer interactions and improving profit margins. The presence of processing units and secondary agriculture adds further value to horticultural products.

The innovations introduced by agricultural startups and the availability of online knowledge banks that disseminate agronomic best practices empowers farmers with the knowledge and tools they need to make informed decisions, adapt to changing conditions, and enhance the overall productivity and sustainability of their farming practices. This not only revitalizes their interest in agriculture but also positions them for long-term success in a rapidly evolving industry.

CULTIVATING RESILIENCE

POST-HARVEST HANDLING AND STORAGE STRATEGIES IN A CHANGING CLIMATE

Climate change is having a significant impact on agriculture, with rising temperatures, sporadic and reduced rainfall, and extreme weather events becoming the new normal and taking a toll on crop yields and quality. This is especially true for developing countries, where farmers are often already struggling to cope with the challenges of climate change. One area particularly susceptible to climate change is post-harvest handling and storage, involving the preparation, transportation, and storage of harvested agricultural produce. If this process is mishandled, it can result in substantial food losses in both quantity and quality.

The Impact of Climate Change on Agriculture

Climate change is no longer a distant threat; it's a present-day reality for farmers. One of the most pervasive effects of climate change on agriculture is the alteration of crop-growing conditions, thereby impacting yields and quality

Rising temperatures tend to have detrimental effects on crop growth and post-harvest quality, causing reduced yields and compromised nutrition. Higher temperatures also accelerate crop deterioration, shortening shelf life.



About the AUTHOR

Varun Khurana, Founder & CEO, Otipy

Sporadic rainfall, including prolonged droughts and storms, disrupts production, reducing yields and quality. Sudden heavy rainfall can damage crops during transportation and storage.

Quality is Compromised

Climate change also triggers physiological and biological changes in crops, accelerating spoilage and altering nutrition due to temperature fluctuations, humidity levels, and contaminant exposure. Warmer temperatures change flowering and fruiting

One of the most pervasive effects of climate change on agriculture is the alteration of crop-growing conditions, thereby impacting yields and quality

timing, affecting harvest seasons. Maize productivity worldwide is decreasing due to rising temperatures and is projected to decline by 24% by 2030.

In light of these challenges, adapting post-harvest strategies to climate change becomes vital.

Post-Harvest Handling Suitable for New Climatic Conditions

To adapt to a changing climate, farmers and supply chain stakeholders must embrace modern, post-harvest handling techniques. Here are some strategies that can help miti-

gate the impact of environmental changes:

1. Modern Fruit Care Techniques: To ensure the production of pest- and disease-free crops, modern fruit care techniques such as integrated pest management (IPM) should be employed. IPM (Integrated Pest Management) utilizes strategic pesticide use, biological controls, and cultural practices to minimize pest and disease impact and helps enhance produce quality and shelf life.

2. Improved Handling Tools and Methods: The use of improved handling tools and methods can significantly reduce post-harvest losses. For example, gentle handling of fruits and vegetables during harvesting and transportation can prevent bruising and physical damage, which can lead to spoilage.

3. Pre-Cooling at or Near the Farm: Pre-cooling, a process of rapidly reducing the temperature of harvested crops, is crucial in preserving their quality. Pre-cooling can be achieved using refrigeration or evaporative cooling techniques. By cooling crops immediately after harvest, farmers can slow down the ripening process, reduce moisture loss, and extend the shelf life of their produce.

4. Packaging Adapted to Climate: The choice of packaging materials and methods should take into account the prevailing climatic conditions. Packaging should protect crops from environmental factors such as excessive heat, humidity, and exposure to sunlight. Additionally, packaging should be designed to minimize moisture loss and prevent microbial growth, further enhancing the quality and safety of agricultural products.

Post-Harvest Transport

Efficient post-harvest transport is essential to ensure that crops reach their destinations in an optimal condition. In the face of a shifting climate, it becomes crucial to adapt transportation methods and logistical plans to counteract the impact of environmental fluctuations. Some possible strategies to achieve this:

Modified Atmospheric Logistics: Modified atmospheric packaging (MAP) can be employed to control the composition of gases (e.g., oxygen and carbon dioxide) within containers holding agricultural produce. This technique helps prolong the shelf life



Efficient post-harvest transport is essential to ensure that crops reach their destinations in an optimal condition

of crops by slowing down respiration and ripening processes. It can be particularly useful in mitigating the impact of temperature fluctuations during transportation.

Secondary Packaging: Utilizing secondary packaging effectively helps mitigate losses during transit, handling, and the respiratory heat of the produce. This packaging safeguards crops from physical damage and environmental conditions, ensuring the produce arrives in optimal condition.

Multi-Modal Supply Chain: Building a multi-modal supply chain that combines various modes of transportation, such as road, rail, and air, can help mitigate the risks associated with climate-related disruptions. By having alternative transport options, agricultural products can continue to move even when one mode of transport is affected by adverse weather conditions.

Post-Harvest Storage

Effective post-harvest storage is essential to maintain the quality and safety of agricultural produce. In a changing climate, storage facilities and methods must be adapted to minimize losses and extend the shelf life of crops. Here are some strategies:

Modified atmospheric storage (MAS) involves controlling the composition of gases

within storage facilities to slow down the respiration and ripening processes of crops. By adjusting temperature and humidity levels and managing gas concentrations, MAS can significantly reduce storage losses and extend the shelf life of agricultural products.

Scientific Design to Reduce Storage Losses involves designing storage facilities to minimize losses due to spoilage, pests, and diseases. Proper insulation, ventilation, and humidity control are critical factors to consider. Additionally, monitoring systems that track temperature, humidity, and gas concentrations can help ensure optimal storage conditions.

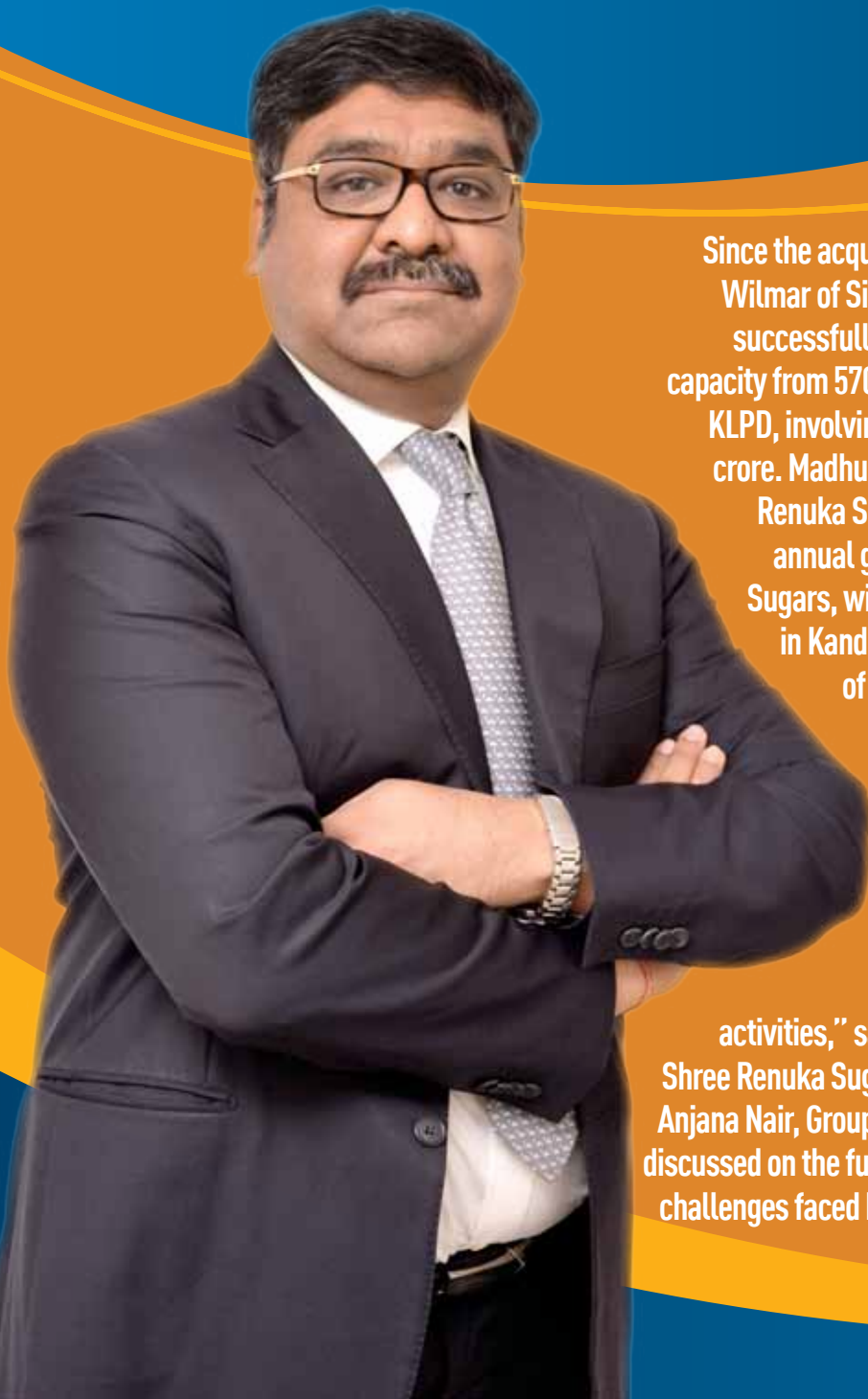
Use of Renewable Energy such as solar power not only helps reduce the carbon footprint of post-harvest storage but solar-powered cooling systems can also provide reliable and sustainable energy sources for maintaining required storage conditions.

Efficient Handling of Produce by minimizing the number of times produce is handled during storage can reduce the risk of physical damage and microbial contamination. Efficient handling practices, such as automated systems and conveyor belts, can help maintain the quality of crops while in storage.

The Way Forward

As climate change continues to pose challenges to agriculture, the implementation of resilient post-harvest handling and storage strategies becomes increasingly critical. Amidst the climate change reality, fostering agricultural resilience is both a necessity as well as an opportunity for innovation. Collaboration among farmers and supply chain stakeholders is key to ensuring sustainable food production in changing environments. By embracing these strategies, we can address the challenges posed by a changing climate and secure the future of agriculture for generations to come.

“ETHANOL SEGMENT IN INDIA HOLDS SIGNIFICANT EXPANSION PROSPECTS”



Since the acquisition of Shree Renuka Sugars by Wilmar of Singapore in 2018, the company has successfully increased its ethanol production capacity from 570 kilolitres per day (KLPD) to 1,250 KLPD, involving an investment of around Rs.850 crore. Madhur Sugars, the brand name of Shree Renuka Sugars has experienced impressive annual growth of over 20%. Shree Renuka Sugars, with its two sugar refineries located in Kandla and Haldia, has emerged as one of India's largest exporters of sugar. “Renuka sugar is a well-known brand in international markets and we export sugar to 60 countries. This year Renuka has exported to as far as Mexico and Chile, with a positive growth trajectory observed in its export activities,” said Ravi Gupta, Executive Director, Shree Renuka Sugars in an exclusive interview with Anjana Nair, Group Editor, Agriculture Today. He also discussed on the future of ethanol production and the challenges faced by the sugar sector. Excerpts from the interview

What is the general production scenario of sugar in India?

India holds the distinction of being the second-largest sugarcane producer worldwide, following Brazil. With approximately 21% of its agricultural area dedicated to sugarcane cultivation, India contributes around 22% of the global sugarcane production. In 2022-23, India's sugar production has been estimated at 32.8 mt, down from 35.8 mt last season, by the ISMA. India's sugar production is projected to be 33.5 million tonnes (mt) in 2023-24 season (October 2023-September 2024)

What are the trends in sugar that you have witnessed globally and nationally?

Considering the global food and beverage industry plays a significant role in driving sugar consumption, it is expected to have a positive influence on the sugar industry, with long-term market growth anticipated. Current estimates indicate that worldwide sugar production ranges from 175 to 200 million tonnes annually, of which approximately 65 to 70 million tonnes are traded internationally, while the remainder is consumed domestically within the producing countries. Over the past decade, the annual growth rate has declined to around 1% per year, compared to the previous 2-2.5%, with key drivers of growth being population expansion and economic development, leading to increased consumption of sugar-laden processed foods. Although the sugar market remains saturated in developed economies, such as North America and Western Europe, it is showing a promising growth in the emerging regions.

From a national perspective, as of February 2023, we have observed a significant year-on-year increase of approximately 5.5% in sugar production. India exported 6.2 million tonnes of sugar in the current sugar season, which is still lower than the export volumes of 72 lakh tonnes and 112 lakh tonnes

tête-à-tête with Anjana



In light of the fact that sugar ethanol is the most practical and affordable source of gasoline ethanol, the rush to meet this predicted ethanol demand may actually benefit the sugar business.

in the sugar seasons of 2020-21 and 2021-22, respectively. The determination of further sugar export will be based on a thorough evaluation of the demand-supply scenario. In addition, the sugar industry could benefit from a potential reduction in Goods and Services Tax (GST) and any further export quota announcements made by the government. These factors, if implemented, have the

potential to support the performance of sugar mills in the near term. Furthermore, the ongoing support from the government towards the sugar sector, coupled with its emphasis on diverting production towards ethanol to promote the Ethanol Blending Program in India, is expected to drive the growth and momentum of the sugar sector moving forward.

How has ethanol production complemented the sugar segment?

Due to India's commitment to using more biofuels, the production of ethanol has grown significantly during the last five years and is continuously growing. The demand for ethanol is going up and will likely continue to rise as the nation strives to attain energy independence. In light of the fact that sugar ethanol is the most practical and affordable source of gaso-



line ethanol, the rush to meet this predicted ethanol demand may actually benefit the sugar business. The extra sugar that is created after consumption can be used to make ethanol. Since it helps the government achieve its goals of becoming self-sufficient and carbon-free, the nation's expanding ethanol programme will be advantageous to the sugar business.

What are the expansion prospects of the ethanol segment in India?

The ethanol segment in India holds significant expansion prospects, supported by promising market trends. The India ethanol market has already reached a volume of around 3200 million litres in FY2023 and is projected to grow at a CAGR of 5.67% until 2035. To meet the country's target of achieving a 20% blending of ethanol in gasoline (E20) by 2025, the ethanol production capacity of molasses and sugar-based distilleries has been increasing.

India's ambitious roadmap for ethanol blending, outlined in the "Roadmap for Ethanol Blending in India 2020-25," provides a clear direction for the expansion of the ethanol industry. The roadmap sets milestones such as increasing domestic ethanol production capacity from 700 to 1500 crore litres, phased rollout of E10 fuel and E20 fuel, and the promotion of technology for ethanol production from non-food feedstock.

What are the policies that have propelled the ethanol units in India?

In order to foster the growth of ethanol units in India, the government has implemented several key policies. One such policy is the National Policy on Biofuels, which aims to enhance domestic ethanol production and encourage its blending with conventional fossil fuels. Ethanol Blended Petrol Programme, which operates under the National Policy on Biofuels, seeks to achieve a target of blending 20% ethanol with petrol (E20) by the year 2025/26. Additionally, the Expert Com-



One of the primary challenges is the seasonal nature of the industry creating a logistical challenge in bridging the gap between sugar factories and the fields.

mittee on Roadmap for Ethanol Blending in India by 2025 has developed a comprehensive plan for the gradual implementation of E20 ethanol throughout the country and has reported that achieving a 20% ethanol blending rate is indeed feasible. These initiatives collectively drive the expansion and development of ethanol units in India.

As an experienced and veteran member of the sugar fraternity, what are the challenges that you have noticed in the segment?

One of the primary challenges is the seasonal nature of the industry creating a logistical challenge in bridging the gap between sugar factories and the fields. If sugarcane is not crushed within 24 hours of harvesting, there is a risk of sucrose loss, impacting overall sugar production. This requires careful coordination and efficient management to ensure timely processing of the harvested crop.

Another significant challenge in re-

cent times has been the impact of weather conditions on sugar production. India has experienced adverse weather conditions in key growing regions, leading to a decrease in the weight and yield of the cane crop. As a result, the country's sugar production has decreased, with a 3% decline in the first half of the 2022-23 marketing year.

Additionally, the government's decision to retain export restrictions on sugar has created hurdles for the segment. The Department of Food and Public Distribution is unlikely to allocate quotas for sugar mills to export or permit Indian mills to export sugar in the upcoming marketing year. This decision aims to ensure domestic supply and stabilize prices, considering the lower-than-expected sugar production in the current season.

What are the future plans of Shree Renuka Sugars?

In terms of sugar production, the company is now exploring investment opportunities in states beyond its current presence in Karnataka and Maharashtra. This expansion plan is driven by the growing demand for sugar in India, which has been increasing by an annual rate of 2% and has reached a consumption level of 27.5 million tonnes. The company remains open to potential acquisitions to support its growth strategy in the sugar industry.



About CACL

Concept Agrotech Consultants is a professionally managed private limited company, providing a wide range of consulting services in agriculture sector. Launched as a private limited company in 1994, CACL has come a long way in providing knowledge-based services to the agri-business sector. A dedicated team of qualified professionals with requisite experience, field network and extensive database of people associated with agriculture at various functional levels, the company is capable of accomplishing any assignment successfully. Over thirty agribusiness clients today acknowledge the company's quality and reliability of services.

BUSINESS SERVICES :

- Research and Studies
- Business Consulting
- Data & Regulatory Services
- Agro Ventures
- FarmIQ - IT Solutions

FARM SERVICES :

- AgroCert (GAP Certification)
- AgroSource (Produce Sourcing)
- FarmerConnect (Contract Farming)
- FarmSolutions (Farm Consultancy)
- Product Services (Marketing and Promotion)

To know more, please Contact :

Mr. Anupam Rai

Division Head - Business Services

Mob : +91 9311983204

Email : anupam.rai@cacl.in

Mr. Rahul Singh

Division Head - Farm Services

Mob : +91 7827947370

Email : rahul.singh@cacl.in

HARYANA

High in Horticulture

Haryana's achievements in agriculture have been surely noteworthy. The state has made miraculous progress in its cereal based production system. But what makes Haryana today the envy of the entire nation is its ambitious drive towards horticulture. The state today is a fertile field for cultivation of fruits and vegetables. From implementing state government's result oriented schemes and programmes to partnering with foreign countries, the state has a clear vision in horticulture. In a conversation with Agriculture Today, Dr. Arjun Saini, Director General, Horticulture, Haryana shares with us the progress achieved and the challenges encountered in making the state a force to reckon with in horticulture.

How did the vision of Horticulture emerge in Haryana?

The implementation of

National Horticulture Plan was the beginning point for horticulture in Haryana. In the last 20 years, there has been an addition of 1 lakh acres under horticulture. Our focus was not merely in increasing the area but more importantly to increase productivity. It was earlier around 12-15 t/ha, but now we have reached 18-20 t/ha. Our target is to achieve 25-20 t/ha by 2030. By this way we will be increasing production and also helping our farmers to increase income from the same area.

What are the factors that led to the increased adoption of horticulture among the farmers in Haryana?

Primarily, subsidies played a key role in popularizing horticulture among farmers.

Haryana is the first state in India to fix minimum support price for vegetables.

Horticulture is capital intensive and so the added incentive from the government was a boon for the farmers. There were several schemes that were introduced by the government to make horticulture lucrative. The Bhavantar Bharpayee Yojana is a unique scheme of Haryana Government for horticulture farmers to compensate for the low price of their produce in the market. Haryana is the first state in India to fix minimum support price for vegetables. Under the scheme, the government will pay the difference in price to the farmers if they had to sell their produce at a price lower than the fixed rate.

A state specific insurance scheme was also initiated in Haryana specifically for horticulture crops. Mukhyamantri Bagwani Bima Yojana (MBBY) is an assurance-based scheme to compensate crop losses due to adverse weather and natural calamities for farmers growing horticulture crops. Crop Cluster Development Programme (CCDP) has emerged as an innovative initiative that combines technological advancements, sustainable farming practices, and market integration to boost agricultural productivity and improve rural livelihoods. This has helped in organized retailing in fresh fruits and vegetable segment in Haryana. There are roughly around 400 such clusters and we are aggregating them. We are targeting 500 in the coming years. Because of the support given by the government, farmers are volunteering to pick up horticulture and I foresee a jump in the area and production.

What are initiatives taken by the government in strengthening the marketing of horticulture



produce?

We are building an International Horticulture Market at Ganaur which will be the biggest market in Asia. With a project cost close to Rs 7000 Crore, the market is fashioned in the manner of Rungis International Market, Paris. This 500 acre market will be hosting venues for traders from International community to FPOs. CCDP combined with this market will establish a complete linkage. This will be in a hub and spoke system, market being the hub and the clusters the spoke from where the produce reaches the market.

Is Haryana ready to explore export of horticulture produce?

Haryana's horticulture produce are not directed for an export market. We ourselves are a big market. The proximity to Delhi, where the demand for fruits, vegetables and flowers is high, gives Haryana's farmers an edge over those from other states, while they are also catering to the local market. But during peak harvest, we will have surplus and they have to settle for lesser prices. Fortunately our Bhavantar Bharpayee Yojana takes care of that. May be in the future, when there is an exportable surplus with a logistical linkage to the outside world, export can be thought about.

How do you describe technology adoption in Horticulture in the state?

One of our biggest achievements has been the adoption of technology. As early as 2008, we signed an MoU with Israeli government to establish Center for Excellence for Vegetables. Today it is one of the biggest and beautiful centers in India. We have several centers with Israeli government in Fruits, Vegetables, Bee Keeping and Semi-Arid Fruits. We also have developed our own Centers of Excellence with different agencies. Now we have 14 Sub Centers of Excellence across Haryana. We use this centers to showcase the technologies which can be replicated in the farm such as cultivation, micro irrigation systems, mulching, sensor based measurement of soil moisture



We are building an International Horticulture Market at Ganaur which will be the biggest market in Asia

and complete and semi automation of irrigation are a few among them. Apart from the technologies, the centers also showcase different varieties of crops. Our centers grow 30 types of crops and their varieties. Green house technologies were non existent in Haryana a few years back. Now we have 3500 acres of land under net house and poly house. Micro irrigation is also increasing 50000 acre per year.

How are the farmers skilled to make use of these technologies?

We have a horticulture training institute in Karnal district where routine training programmes are conducted. We have tied up with Skill Council of India and now we are undertaking 22 skill courses. These are 2-3 month duration courses open to plus 2 and matric students. Now training is extended to 7 training centers and 11,400 farmers and students have been trained.

What are the challenges of horticulture in Haryana?

The biggest challenge is the inclination of

the state towards cereal crops. Farmers are much comfortable growing the same crop with an assured buy back from the government. Perishability of the horticultural produce is another concern which needs to be addressed. Another challenge is the adoption of new technologies. Technologies are developing at a faster rate and so are their costs which can be a deterrent for farmers from adopting them. Haryana's natural resources bear certain disadvantage towards farming. 50% of water in Haryana is brackish. Many horticulture crops are therefore not suitable to us. We will have to address these challenges in near future.

What are the future plans?

We have our own vision documents - Vision 2030 and Vision 2040 according to which we intend to increase area under horticulture by 10-11 % by 2030 and 18-20% by 2040. We are also expecting to increase productivity from 15-20t/ha to 25-30t/ha. We are planning to introduce several schemes and programmes to achieve this such as establishment of market network in public and private sector. We are in final talks with Japan and are expecting assistance of Rs 2500 Crore. It will be one of the biggest projects of Horticulture in India by any international agency. This will help in bringing some of the advanced technologies in horticulture in India.

HORTICULTURE

FARM TO FORK VIA QUALITY MANAGEMENT

The term "Horticulture" often conjures images of gardens and nurseries, but it encompasses far more than that. It encompasses the cultivation of a diverse range of crops, both for sustenance and non-food purposes. Our honorable Prime Minister, Shri Narendra Modi, has consistently emphasized the imperative of doubling farmers' incomes, underscoring the pivotal role that horticulture plays in achieving this goal.

Horticulture – Driver of Agriculture Growth

Horticulture serves as a fundamental and enduring cornerstone within the agricultural sector. This vital branch of agriculture focuses on the cultivation of plants and vegetables for diverse purposes, encompassing food, medicinal, and various other applications. What sets horticulture apart is its labor-intensive nature, its ability to yield higher productivity, its market-oriented strategies, and its reliance on technology-driven practices. Consequently, it emerges as an attractive and pivotal driver of agricultural growth. Notably, horticulture holds a special allure for small and marginal farmers, as it promises heightened profitability and economic prospects.

The horticulture sector in India produces around 320 million tonnes of products and contributes about 33% of the Gross Value Addition (GVA). Global horticulture production has reached approximately 2.5 billion metric tonnes in 2020, according to the Food and Agriculture Organization (FAO). Among major economies China, India, and the United States are the world's leading producers of horticultural products,

The horticulture sector in India produces around 320 million tonnes of products and contributes about 33% of the Gross Value Addition (GVA).

with China being the largest producer of both fruits and vegetables.

Quality Assurance & Certification

Quality assurance & certification is the bulwark of the horticulture value chain, ensuring the highest standards from farm

to fork. In the global agricultural trade arena, particularly in the realm of horticulture (fruits and vegetables), the bedrock rests upon the meticulous maintenance of quality, aligning with the directives of the World Trade Organization (WTO) and regional market regulations, including phytosanitary and post-harvest protocols. The Foreign Trade Policy of 2023 has prominently emphasized one of its pivotal objectives: the enhancement of capacity and infrastructure development. This multifaceted approach encompasses testing, branding, packaging, and other essential facets to meet and exceed the stringent standards set by global value chains, ultimately fostering a



About the **AUTHOR**
Varsha Misra, Deputy Director,
Quality Council of India



In today's global agricultural landscape, particularly in the trade of horticultural products, success hinges not only on the sheer scale of production but also on a qualitative scale that aligns with contemporary imperatives.

seamless flow of trade."

The Government of India (GoI) has launched a series of strategic initiatives aimed at elevating the country to the forefront of global horticultural production and trade. These initiatives encompass programs like the Cluster Development Program (CDP), the Mission for Integrated Development of Horticulture (MIDH), as well as adherence to international standards such as Global G.A.P. and INDGAP.

Accreditation and Certification Infrastructure

The global demand for certified horticultural products is driven by several factors such as consumer preferences, food safety concerns, environmental sustainability and export opportunities. Certification plays a multifaceted role in horticulture. There are various schemes involved in accreditation and certification at global level such as Rainforest alliance, USDA Organic, AGMARK, Ecocert, Geographical Indications (GI) Tags etc. In today's global agricultural landscape, particularly in the trade of horticultural products, success hinges not only on the sheer scale of production but also on a qualitative scale that aligns with contemporary imperatives. These include addressing societal concerns like health and safety, environmental stewardship, fair trade practices, consumer protection, and adherence to regulations.

The Government of India has entrusted various institutions like BIS, NABL, NABCB, and APEDA with the critical responsibility of ensuring national and international quality standards for products and services. This delegation aims to address the concerns

and expectations of both businesses and consumers. The quality assurance framework in India operates through a well-defined system involving various key entities. The Bureau of Indian Standards (BIS) plays a pivotal role in standardizing products, offering certifications like AGMARK and ISI to ensure quality and conformity. Meanwhile, the National Accreditation Board for Testing & Laboratory Calibration (NABL) takes charge of rigorously testing and calibrating products to meet international standards, addressing the demands of global markets.

National Accreditation Board for Conformity Bodies (NABCB)

At the heart of this quality infrastructure lies the National Accreditation Board for Conformity Bodies (NABCB), which plays a central role in overseeing and ensuring holistic quality assurance through third-party entities across the nation. NABCB extends its influence globally through participation in multilateral agreements (MLAs), reinforcing India's commitment to international quality standards and harmonious global trade. NABCB's involvement contributes significantly to enhancing the credibility and global acceptance of horticultural products from India. The establishment and implementation of the National Program for Organic Production (NPOP), INDGAP, and GlobalGAP standards are the tangible results of NABCB's dedicated efforts aimed at enhancing the quality and sustainability of agricultural products. India, being primarily an agrarian nation, relies significantly on its agricultural exports to contribute to its economy. These initiatives

reflect the commitment to maintaining and elevating the standards of agricultural production in the country, ultimately bolstering India's position as a reliable and responsible global agricultural supplier.

Challenges

Despite the noteworthy progress achieved by NABCB in accrediting certification bodies within India's horticulture sector, several pivotal challenges persist. These encompass the ongoing need for continuous training and capacity-building initiatives, the imperative of aligning NABCB's accreditation standards with globally accepted norms, the advocacy for sustainable practices, the swift integration of cutting-edge technology, and the strategic allocation of resources towards essential infrastructure enhancements.

Certified horticulture has evolved into an integral element of the global trade landscape, effectively catering to the surging demand for horticultural products that are not only safe but also of superior quality and produced sustainably. In this ever-evolving horticulture sector, the NABCB plays a central role by upholding and enhancing accreditation standards, thereby steering India's horticultural trade towards a promising future on the global platform. With a commitment to practices such as organic farming, safeguarding Geographical Indications (GI), and aligning with international standards, India stands poised to secure an even more substantial share of the global certified horticulture market. This accomplishment will not only benefit Indian farmers but also contribute significantly to the nation's economic prosperity.

UNLOCKING THE POTENTIAL OF COLD CHAIN INFRASTRUCTURE IN INDIA

In a country as diverse and dynamic as India, the need for a robust cold chain infrastructure has never been more pressing. From the fertile fields of Punjab to the bustling markets of Mumbai, the demand for safe, reliable, and efficient storage and transportation of perishable goods is on the rise. The cold chain industry holds immense potential to revolutionize various sectors, from agriculture and food processing to pharmaceuticals and e-commerce.

The Need for Cold Chain Infrastructure

India's agriculture sector is a cornerstone of its economy, providing livelihoods to millions and feeding a population of over a billion. However, a significant proportion of agricultural produce goes to waste due to inadequate storage and transportation facilities. The absence of proper cold storage leads to spoilage, reducing the income of farmers and contributing to food insecurity. A robust cold chain can help bridge this gap by extending



According to the Indian Ministry of Food Processing Industries, the country loses around 30% of its agricultural produce annually due to lack of proper storage and transportation.

the shelf life of perishable goods, reducing post-harvest losses, and ensuring a steady income for farmers.

Furthermore, the food processing industry in India is burgeoning. With changing consumer preferences and a rising middle class, there is a growing demand for processed and packaged food items.

Cold chain infrastructure is essential for maintaining the quality and safety of these products throughout the supply chain, from farm to fork. It also enables the export of high-value agricultural products to international markets, enhancing India's global trade footprint.

Challenges in Cold Chain Development

Despite its potential, the development of the cold chain industry in India is hindered by several challenges. One of the primary hurdles is the lack of proper infrastructure. Cold storage facilities, refrigerated transport vehicles, and temperature-controlled warehouses are sparse, particularly in rural areas. This scarcity not only limits the reach of cold chain services but also makes them costlier, impacting the accessibility of these services to small and marginal farmers.

Energy availability is another critical challenge. Reliable power supply is essential for maintaining the cold chain, but many parts of India still experience frequent power cuts and voltage fluctuations. This can disrupt the temperature-controlled environment required for perishable goods, leading to spoilage and



About the **AUTHOR**
Dr. Harish Jain
 Translation officer
 Parliament of India



financial losses.

Technology adoption and awareness are also barriers to cold chain development. Many farmers and stakeholders in the supply chain are unaware of the benefits of cold storage and the proper handling of perishable goods. Educating them about the advantages of cold chain infrastructure and best practices is essential for the industry's growth.

The Transformative Impact

If India can overcome these challenges and develop a robust cold chain infrastructure, the impact could be transformative. First and foremost, it would significantly reduce food wastage. According to the Indian Ministry of Food Processing Industries, the country loses around 30% of its agricultural produce annually due to lack of proper storage and transportation. A well-functioning cold chain can substantially reduce this loss, ensuring more food reaches consumers' plates.

The growth of the cold chain industry would also have a positive effect on employment. From setting up cold storage units to operating refrigerated transport vehicles, various job opportunities would emerge across the value chain. This could provide employment to thousands of individuals, particularly in rural areas.

Moreover, the e-commerce industry is booming in India, and it heavily relies on a

Reliable power supply is essential for maintaining the cold chain, but many parts of India still experience frequent power cuts and voltage fluctuations.

well-established cold chain for the delivery of fresh produce, dairy products, and other perishables. With the growth of online grocery shopping and meal delivery services, a strong cold chain becomes a competitive advantage for e-commerce companies aiming to provide high-quality products to consumers.

Steps Towards Cold Chain Development

To harness the full potential of the cold chain in India, several steps need to be taken:

Infrastructure Development: Investment in cold storage facilities, refrigerated transport, and temperature-controlled warehouses is crucial. This would expand the reach of cold chain services and make them more affordable.

Energy Solutions: Implementing backup power solutions, such as solar panels and generators, can mitigate the

impact of unreliable electricity supply on cold chain operations.

Technology Adoption: Promoting the use of advanced technologies like IoT (Internet of Things) sensors and real-time monitoring systems can help maintain optimal conditions for perishable goods throughout the supply chain.

Education and Training: Conducting awareness campaigns, workshops, and training programs for farmers, suppliers, and other stakeholders will ensure proper handling and storage of perishable goods.

Public-Private Partnerships: Collaboration between the government, private sector, and other relevant stakeholders can accelerate the development of cold chain infrastructure and ensure its sustainability.

The potential of the cold chain industry in India is undeniable. From reducing food wastage to improving supply chain efficiency and quality assurance, its benefits are far-reaching. However, the challenges are significant and require collective efforts from the government, private sector, and communities. By addressing these challenges and implementing strategic solutions, India can unlock the true potential of its cold chain infrastructure, driving economic growth, reducing wastage, and ensuring a more secure future for its farmers and consumers alike.

NATURAL GREEN HOUSE

A Game Changer

Poly houses have demonstrated to improve incomes and offer improved productivity to farmers. However, the cost incurred can be a deterrent to its adoption. Kondagaon model of 'Natural Green House' developed by Farmer scientist Dr. Rajaram Tripathi of Bastar, is a cheaper, effective and natural alternative to a Poly house.

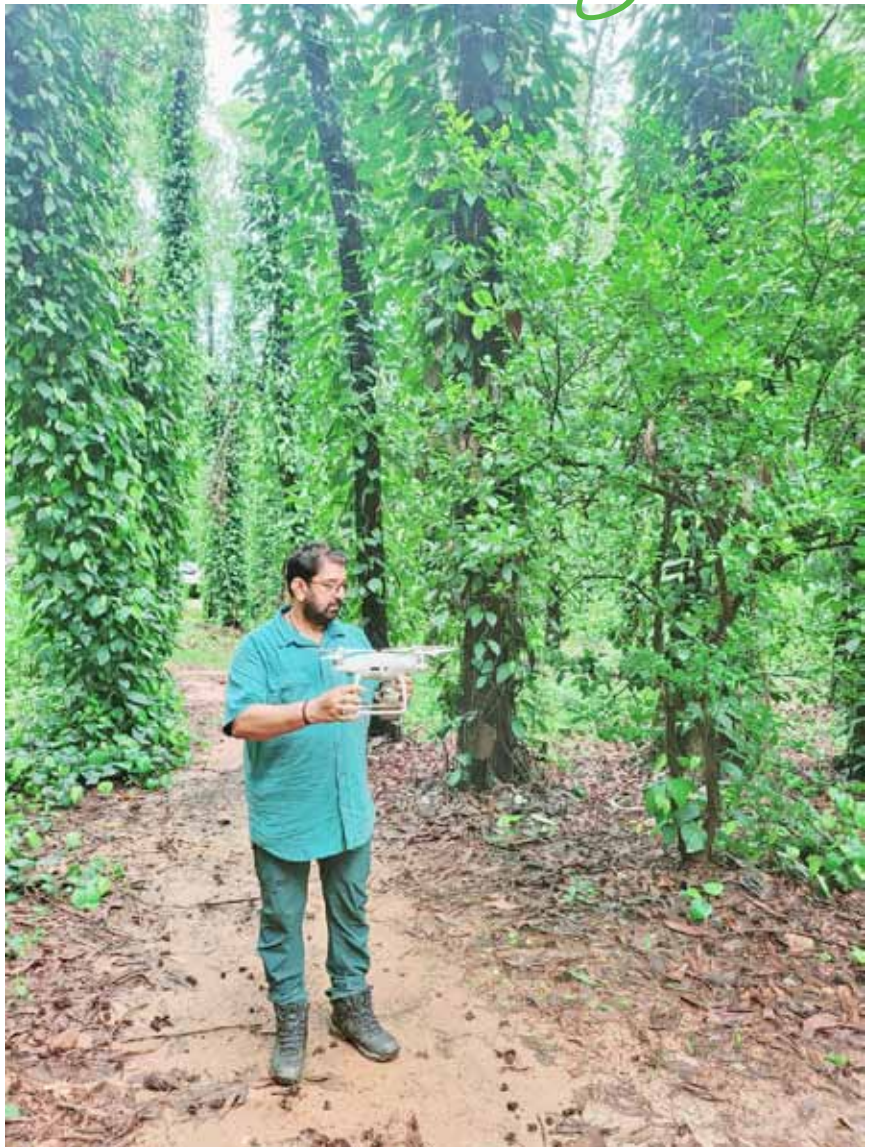
Dr Tripathi has planted black pepper (BP) MDBP 16 vines on Australian-Teak (AT) MDAT16 trees in his one-acre "Natural Green House". This Australian teak and black pepper cultivation is called the 'Kondagaon model of ATBP'. The team from

Income can be increased through vertical farming only up to 10-12 feet height in Poly House, whereas in Natural Green House, the Australian teak trees are loaded with bunches of black pepper up to a height of 70-80 feet

IISR (Indian Institute of Spices Research), Calicut inspected and praised the quality of Black Pepper. The average production too was higher than the conventional pepper plantation. The pepper farms of Dr. Tripathi gave 8-10 kg/vine as against the national average of 1.5 to 2 kg.

"Natural Greenhouse" Model of Farming

This model can be replicated anywhere in the country except in places of heavy



About the **AUTHOR**

Dr Rajaram Tripathi, Farmer Scientist & Founder, Maa Danteshwari Herbal Farms and Research Centre

snowfall or in desert. It can be successfully planted even in gravelly, rocky, barren lands. Not only this, it also makes barren land fully fertile in a few years.

Natural green house is a cheaper alternative. While a conventional poly-

house cost Rs 40 lakh per acre, Dr Tripathi's green house cost Rs 1-1.5 lakh. Its natural green cover provides effective and necessary protection from ultraviolet rays and natural shade of 60-70%, similar to polyhouses.

In Natural Green House, there is a difference of up to 4 degrees from the inner temperature and the outer environment i.e., it remains cool in summer and warm in winter, due to which almost all common crops can be grown well in all three seasons. It also protects against strong wind storms. Additionally, the layer of leaves that regularly fall from trees prevents valuable moisture from the soil from being released too quickly. By regular nitrogen fixation in the roots of special type of trees planted in "Natural Green House" and by composting of the fallen leaves of the trees, organic fertilizer are made available at no extra cost. It also provides excellent organic fertilizer worth about Rs. 2 lakh per acre per year.

Durable and Cheap

Due to "Natural Integrated Protection System" ('IPS'), crops protect themselves effectively from diseases and insects. The natural green house is very durable and can be reaped for 25-30 years with necessary pruning every 10 years. The films and fixtures of Poly House have a maximum life span of seven to eight years only. Poly house turns into junk after about 10 years while "Natural Greenhouse" gives valuable wood worth Crores of rupees after 10 years.

Income can be increased through vertical farming only up to 10-12 feet height in Poly House, whereas in Natural Green House, the Australian teak trees are loaded with bunches of black pepper up to a height of 70-80 feet. Its plantation also provides the benefit of carbon trading.

Maa AT

It is a special species of Acacia developed and propagated by Danteshwari Herbal Farm and Research Centre, which is often called "Australian-Teak" in marketing language. The reason for its association with the word Australia is probably because of



Due to this organic nitrogen fertilizer, the production of black pepper from the black pepper vines planted on these trees is much more than the production being taken in other parts of the country

its large plantations in Australia. Or may be because of its import from Australia.

This special species gives excellent wood and has many characteristics. It is being grown successfully in all parts of the country in all types of climates without any special irrigation or care. Its grows faster than mahogany, rosewood, teak, Millia Dubia and even surpasses Eucalyptus. And in about 7 to 10 years, this tree not only becomes quite tall but also becomes quite thick.

It gives excellent strong, light, beautiful,

Adv. Apurva Tripathi 'QC and IPR' Head of 'Maa Danteshwari Herbal Group' says that "MDHP's one of its kind model of Farming: "MULTI-LAYER SUSTAINABLE GREEN HOUSE SYSTEM" is already applied for Registration at The Controller of Designs, THE PATENTS OFFICE, and we are happy to announce that it is accepted.

durable valuable timber like teak, mahogany and rosewood. It gives twice the amount of timber as compared to other trees.

A very important advantage of this tree is Nitrogen fixation. In this way, it fulfills the requirement of nitrogen and can be called an organic urea factory. Due to this organic nitrogen fertilizer, the production of black pepper from the black pepper vines planted on these trees is much more than the production being taken in other parts of the country.

Better Incomes

The specialty of this model is that the bigger the area it is done, the lower the cost and relatively higher the profit. Because increasing the area also increases the number of trees, and more trees create a better microclimate, which increases production

For one and a half lakh rupees, they provide a better and more durable version. The Poly house made of iron and plastic, cost 40 lakh rupees per acre and has a maximum life of 7 to 10 years and then it is sold at the rate of scrap. While the "Natural Green House" of the Kondagaon model provides valuable timber worth up to Rs. 2 Crores in 10 years without any additional cost, along with the annual regular income from black pepper up to Rs. 5 lakh per acre. This model gives comfortable benefits for about 25-30 years.

Looking at the income of lakhs per acre per year from this model, as well as other important advantages, it is clear that 'Natural Green House' model will be a considered a "Game-changer".

DIVYA RAWAT

THE MUSHROOM LADY

Divya was working with Shakti Vahini, when she noticed a steady flow of migrants from Uttarakhand. Lack of opportunities in the state and the desire to earn more income had made these choices a natural recourse for disadvantaged sections. Divya resolved that she needed to go back and work for the people in Uttarakhand and provide them with a dependable source of income. Born in Chamoli village in Uttarakhand, Divya Rawat had completed her Masters in Social Work and was working with a Delhi based NGO when disastrous floods of 2013 struck her home state. She decided to return.

"Agriculture was a big part of our culture. I wanted to empower the people in my state with something that they were familiar with. Mushroom cultivation got my attention because temperature was the sole determinant for cultivation of mushroom. Being cultivated indoors, it was immune to climate vagaries or attack by wild animals, both of which are biggest issues in conventional farming in Uttarakhand."

Seeds of an Enterprise

But before she could convince the farmers, she decided to taster her own remedy. She dived into mushroom farming. She established 'Soumya Foods Pvt Ltd. "I started with Oyster, Milky and Button Mushroom. I demonstrated to them that mushroom cultivation was remunerative."

People started to acknowledge it as a veritable means to livelihood. Gradually many came forward. But then there was the problem of access to spawn. It was not feasible for smaller farmers to buy



spawn from big commercial labs. Divya started to place orders for them. "Securing spawn was then a big challenge. I decided to set up a separate company for spawn production - Sowmya Spawn Lab Pvt. Ltd. "

Divya also started a multi cuisine restaurant in Dehradun, "Mush Mush" in a bid to display the organic healthy options

About 3 lakh people are connected with Divya from all over India

to the urban community. All the mushrooms that are cooked in the restaurant are procured from Divya's farms.

Value Addition

There are different species of mushroom that can be grown year round depending on the temperature. The rates prevailing in the market also varies from Rs.100/kg to the pricier, Cordyceps (Kida Jadhi in Hindi) Rs. 3,50,00/Kg, the cultivation of which Divya initiated in India. Mushrooms are perishable and so Divya resorted to dehydration, which reduced the water content in the mushrooms and improved

their shelf life. “Dehydration was not something new in the pahadi region. We are used to this technique and in regional language we call it as ‘sukhsa’. However for mushroom we use hot air oven. This increased the shelf life by 1-2 years.”

Divya also created several value added products such as Mushroom Health Masala, Mushroom Macaroni, Mushroom Mayonnaise, cosmetics shampoo, body lotion etc. She claims that she produce around 70-80 value added products from mushroom.

Astute Learner

Divya like gathered information and attended training to further her knowledge and to create systems that were suitable to the geographical region from where she was operating. Her training took her to Thailand, Malaysia, Vietnam, Belgium and Netherlands.

“Initially I took training from the horticulture institute in Uttarakhand, Directorate of Mushroom Research, ICAR, Himachal Pradesh and many parts of India. Honestly I was not satisfied. I was not looking for button mushrooms. I was eager to learn about different mushrooms. I decided to reach out to other countries.” Her training extended for 4-5 years.

From Farm to Foundation

At the age of 23, she had decided to be an entrepreneur and her family supported her throughout her journey. Her trainings itself cost her Rs 2 Crore.

“My first farm was hardly 100sq.ft. I started with Rs.20,000. Today my turnover is Rs 20 Crore. Within 2 years, my turnover will be Rs 200 Crore. Today my work is recognized and I am giving training to people from all across India. I want to raise mushroom entrepreneurs”.

About 3 lakh people are connected with Divya from all over India. Sixty per cent are from Uttarakhand and rest from the other parts. She support them and procures their product.

“Right now, I am working on Avantam Himalaya Foundation. It will be a collaboration of 4000 women under MSME scheme. These women will be the share



Divya Rawat is the official Brand Ambassador (Mushroom) for Uttarakhand government

holders of the company. We have selected 70 women who are the master trainers and entrusted with the responsibility of managing 100-200 women. Pauri Garhwal is a big district. 100-200 women who live close by will be grouped together to grow mushroom in a common facility. We are promoting them to produce



agriculture produce as well.” She plans to procure their produce as well.

Improvisation

The biggest challenge that Divya faced was that of technology. She realized in her journey that India lagged behind in technology. Her trainings in foreign countries made up for that. However, she never followed them blindly. She improvised them and used according to her needs. As she puts it, ‘We are using science with common sense.’

“I don’t use AC but charcoal cooling system to manage temperature. That has cut down on the cost of machinery and electricity bills as well. We have added technology but in a simple way. Similarly instead of autoclave I use steam chambers for sterilization. “

Awards and Honours

Divya Rawat is the official Brand Ambassador (Mushroom) for Uttarakhand government. She has received several awards for her work at the national as well as the state level, including the prestigious ‘Nari Shakti Puruskar’ presented to her by the then President of India, Pranab Mukherjee in 2017. The Horticulture Department of Uttarakhand government awarded the ‘Udyan Pandit Puraskar’ to her. She is on the board of G B Pant Agriculture.

BUILDING TALENT FOR HORTICULTURE DEVELOPMENT



Agriculture has been at the center of the Indian growth journey. The sector contributes around 18% to the overall GDP of the country. The growth CAGR of the Agriculture and Allied sectors has been around 19% in the last three years. This is an indicator that despite all odds (COVID-19) the sector delivers at its best. A farmer never takes rest, till the crop gets harvested because he/ she has a bigger responsibility of feeding the family, livestock, and the country. That's why India is an agrarian economy where the national income of India consists of 70%

Ritesh Bhardwaj
Chief Human Resources Officer
National Bulk Handling
Corporation

The per capita fruit availability in our country is less than 200 gm per day, whereas the recommended quantity is 230 gm per day.



of income generated from agriculture. Pre-independence, the economy was 95% dependent upon the agriculture sector.

Agriculture Education

If we look back at the history of agriculture education in India, the subject was part of the curriculum at Nalanda and Takshila Universities. Education in agriculture sciences started in 1877 from an agriculture college at Saidapet in Madras. Consequently, five agriculture colleges were established in Kanpur, Coimbatore, Nagpur, Pune, and Sabour. At the time of independence, the country had 75 agriculture colleges and universities.

The agriculture science education which was not the first choice in India among the youths, has seen a growing trend in the application for admission. The number of applications has increased by 58% for the Undergraduate program, 12% for Post Graduate Program, and 200% for the Ph.D. program between 2016 to 2020.

Horticulture in India

Horticulture is one of the diversified subjects within the broader area of Agriculture Science. During the modern Indian period of history, the emphasis on horticulture was given and hence, the first horticulture society was formed in 1820 by Rev William Carey. Post-independence, the constitution of the National Horticulture Board was done in 1984. The horticulture sector growth has been tremendous from 8.8 tonnes per hectare in 2001 to 12.1 tonnes per hectare in 2020. The sector has the potential to grow further at the rate of 4.19% with an estimated value of USD 271.25 million by 2030.

The reason for such exponential growth is the demand for fruits and vegetables among both urban and rural populations. As per the study, the calorie intake through fruits and vegetables among the urban population is more than 10% whereas, this is 1.89% among the rural population. The per capita fruit availability in our country is less than 200 gm per day, whereas the recommended quantity is 230 gm per day.

Human Resource in Horticulture

Where there is an opportunity for growth in Horticulture in India, there is a lack of interest among the students enrolled in the agriculture science course. While talking to 25 students from different agriculture colleges, it was shared that the Horticulture specialization is not lucrative because most of the time is spent in gardens and farms. The initial career most of the time is spent in the field and hence, it's a very laborious job. Since the field is not organized yet, there are very few established big brands in the same. Most of the job openings need a specialization in vineyards, farms, and fruit orchards. Other than this, the regular job of a horticulturist is to develop the nursery, conduct trials, collect data, and do analysis of the trials on the vegetables, fruits, and herbs in the forest and fields.

While talking to one of the owners of the orchid farm owner in Nasik, Maharashtra, the issue of shortage of labor is common because of seasonal

In the future, we should leverage the best-in-class scientists from the Indian Council of Agriculture Research (ICAR) to mentor young graduates and train the farmers on best horticulture practices, for better productivity with the help of technology.



business and lower wages in comparison to other sectors. But, over the years, the dependency on labour has come down because of using the machinery and new farming equipment.

Support Systems

Focused Approach

A focused program like MIDH (Mission of Integrated Development and Horticulture) will be helpful in improving the productivity of fruits, vegetables, root & tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, cocoa, and bamboo in the horticulture. It will also encourage aggregation of the farmer groups, support skill development, and create employment in the allied fields like – cold chain, storage, and logistics.

Talent

The growth of the sector is dependent upon the continuous availability of talent with expertise in Horticulture. The NAHEP (National Agricultural Higher Education

Project) program of the Government of India in collaboration with the World Bank with a total project cost of USD 165 million is developed to further strengthen agriculture education for a continuous flow of quality talent in the sector.

Technology

Technology plays a crucial role in better planning of crops and harvesting depending upon the weather forecast and soil conditions. In some cases, the technology will also be used in the future to identify the right farms for a crop at the country level to further enhance productivity. The Ministry of Agriculture is working on a project called CHAMAN (Coordinated Horticulture Assessment and Management using geoinformatics). This technology will help in forecasting the appropriate agricultural land and productivity for seven major crops in 185 districts.

Way Forward

The strategic approach in building the talent pool with expertise in Horticulture with the help of Indian Agriculture Universities, leveraging programs like NAHEP will be required. In the future, we should leverage the best-in-class scientists from the Indian Council of Agriculture Research (ICAR) to mentor young graduates and train the farmers on best horticulture practices, for better productivity with the help of technology.

There is an opportunity for private companies who are currently operating or planning to enter allied fields like – warehousing, cold storage, commercial / lease farming, logistics, etc. to design customized programs for the young rural population in the field of horticulture, to develop a talent pool for fast growth and higher employment generation in rural India.

SOILLESS SAFFRON SUCCESS IN INDOOR CULTIVATION



Ramesh Gera, an electrical engineer by profession made an unlikely business choice of advanced farming. At 64 years of age Ramesh quite deftly operates and manages “Akarshak Saffron Institute” where indoor cultivation of saffron, microgreens and hydroponic farming of vegetables is practised.

Beginning of a New Career Path

“Since beginning of my career, I had a very strong belief that Engineers can do anything in any field, and I had a very strong inner desire that time will come when I would want to do my personal contribution towards upliftment of society and some contribution in nation building. I was in search of an appropriate field where I could have created an impact in-line with my dreams and desires.” Ramesh’s desire to do something different bore fruit. In the year 2002, he happened to travel to South Korea where he witnessed highly advanced multilevel, soilless farming practices including hydroponic farming, microgreens, indoor saffron cultivation and other multilayer organic farming.

It left a lasting impression on him and he was keen to explore this new field. In the available six months in South Korea, he utilised the weekends and holidays in learning all kinds of advanced farming practices. In the year 2017, after he retired, he dived fully into advanced farming which included hydroponics, microgreens, Indoor Saffron cultivation and multilayer organic farming .

A Hidden Opportunity

Originally from Hissar, Haryana, Ramesh has been settled in Noida for the last 27 yrs. In 1980, he graduated in Electrical Engineering from REC (now NIT) Kuruk-

The saffron bulbs procured from Kashmir, after proper initial treatments were made to grow in the greenhouse on multilevel stacking racks and wooden trays in the month of August.



shetra. With a productive 36 years of rich and diversified work experience in reputed MNCs, Ramesh had many opportunities to travel across the globe. He had visited Japan, South Korea, Taiwan, UAE, Libya, Nigeria, Philippines and a few more European countries for official technical assignments.

“In the year 2017, I retired and immediately after that I started experimenting at home in advanced farming including Indoor Saffron cultivation. I was familiar with the fact that the Saffron in soil is grown only in Kashmir because of a very specific suitable climate in that region. I was also aware that cultivable land and produce per hectare for saffron was rapidly declining and there was a very big demand and supply gap in our country for saffron. Our country is largely depend-



ent upon imports of saffron from Iran. “Ramesh could sense a good opportunity to develop soilless technique which will help in reducing the pressure on saffron cultivation in Kashmir.

A Modified Environment

As he had taken care of soil, he made sure the indoors of his saffron crop was modified to be the exact replica of climate in Kashmir. Equipment and facilities to maintain low temperature, high humidity and low intensity of light was installed in a closed room to which he named as greenhouse.

The saffron bulbs procured from Kashmir, after proper initial treatments were made to grow in the greenhouse on multilevel stacking racks and wooden trays in the month of August. “It takes about 3 months for saffron bulbs to give flowers. In the fourth month (November) the flowers and saffron (red stigma) from flowers are harvested. This technique works very satisfactorily to get good yield and quality of saffron.”

In a room of size is 10X10 sq.ft of floor area and 8 ft in height, a temperature as low as 5°C, humidity as high as 85%, light intensity as low as 200 to 600 lux and continued airflow was maintained. He obtained these climatic parameters through equipment i.e. a Chilling device, humidifier, PUF panel insulation on all the walls, roof and floor and thermal windows. The temperature and humidity are regulated through digital electronics systems. The slotted angle racks and wooden trays are provided in the room for placing saffron bulbs for germination.

An Economic Analysis

In the first year, he incurred an initial cost of Rs.6 lakhs which included installing equipment and facilities. He spent Rs. 2.00 lakhs for procurement of Saffron bulbs from Kashmir. The running cost for growing saffron included electricity bill that comes-out to be around Rs. 18,000 in one year, and labour cost of the order of around 6,000 to 8,000/- in one year. In this way cost of producing saffron in a cycle of one year is very low i.e. around



Saffron sells at Rs. 2.40 lakhs in whole sale market. While in retail market it is sold above Rs. 3.50 lakhs per kg.

25,000/- per year.

The saffron (Kesar) is harvested in the month of November every year. “There is a very high demand for saffron in our country. Ayurvedic medicines manufactures are the biggest consumers of saffron. Households also buy and consume saffron for various health purposes and other miscellaneous applications.”

Ramesh claims that the saffron produced through this technique is no different from the ones produced in Kashmir. “As the basic seeds (the bulbs) are brought from Kashmir, only the climate is created artificially, the saffron produce from this technique is good in yield and quality at par with the best of brand Mogra of Kashmir.”

Saffron sells at Rs. 2.40 lakhs in whole sale market. While in retail market it is sold above Rs. 3.50 lakhs per kg.

A Pioneer

Ramesh’s prime objective is to create awareness and spread the knowledge

across the country on subjects of advanced farming. He wants to educate Indian youth about the opportunities existing in the field of farming and make it a preferred business and source of their livelihood. He uses his saffron facilities as a lab for imparting training to interested candidates.

“I have been seeing a few of Saffron growing videos in YouTube, but I have never checked or spoken to any of the persons / parties uploading these videos, so I don’t have any knowledge if some other person / party is doing similar work. As per my understanding, I am the only person putting such efforts.”

Apart from saffron he also produces exotic vegetables and flowers at his home through soil-less hydroponic technique. He cultivates about 50 varieties of microgreens and also conducts training programs on these items.

His Family

Ramesh lost his wife, Sangeeta Gera, about 6 years ago. She was a School Teacher in Noida. His Son, Akarshak Gera, is now settled in Australia and working with a US based MNC. His daughter, Khushboo Gera is settled in Mumbai and working with an MNC in the field of AI (Artificial Intelligence).

PERI URBAN AGRICULTURE AND URBAN PLANNING

Over the years (from early 1990s), developmental aspects of PPP have been taken in micro, medium and SME sectors. In particular, work done in agriculture sector is giving encouraging insight into PPP and its adaptability for social equity based development. The potential of converting grants into viability gap funding is now being applied for agricultural value chain projects. This has also the potential for urban micro medium and SME sectors. The urban local bodies have had the experience of handling PPP projects. PPP institutional mechanisms for developing projects under micro, medium and SME with urban local bodies as initiators of social equity based PPP and additional training and capacity building of ULBs will be required particularly for handling new sector like urban agriculture.

Urban Decentralisation by Incentivizing Peri Urban and Urban Agriculture

It is now part of a growing trend in cities globally to look towards locally produced food. It is worthwhile to consider this specific aspect in the context of urban decentralisation. The technical and financial efficiency as applied in the agriculture sector is largely focussed on rural based farming. However this efficiency can be easily and seamlessly extended for urban agriculture provided it is linked to city planning and its current institutional mechanisms.

Besides city administrations, urban agriculture has started drawing the attention of many non-governmental organisations (NGOs), community groups, and citizens. At the global level, the Food and

At least 55% of the world's population already lives in urban areas and up to 70% of all food produced globally is destined for consumption in urban spaces.

Agricultural Organization (FAO) believes urban and peri-urban agriculture has a role in food and nutritional security.

Linking Urban Agriculture with Decentralised Urban Planning

Urban agriculture can enhance sustain-



able development, food security and nutrition in urban and peri-urban areas, and nearby rural spaces. It will require vast range of policies, programmes and initiatives developed and implemented in partnership with different stakeholders: civil society, academia, national and state agencies, International agencies, City Networks and relevant public and private bodies and entities. Social equity based PPP is a method that can guide its development in India.

At least 55% of the world's population already lives in urban areas and up to 70% of all food produced globally is destined for consumption in urban spaces. Social, economic and environmental sustainability of food systems and the evolution of urban diets will be largely dependent on the management of food systems in urban and peri-urban areas. Therefore, a greater focus on linking urban agriculture with decentralised urban planning is long overdue.

Global Scenario

At the global level, many agencies (eg FAO) believes urban and peri-urban agriculture has a role in food and nutritional security. In several countries, community organisations and individual city residents, facilitated by city administrations, have taken up small-scale agricultural activities on private and public lands.

In Paris, peri-urban agriculture ac-

About the AUTHOR

Tushar Pandey

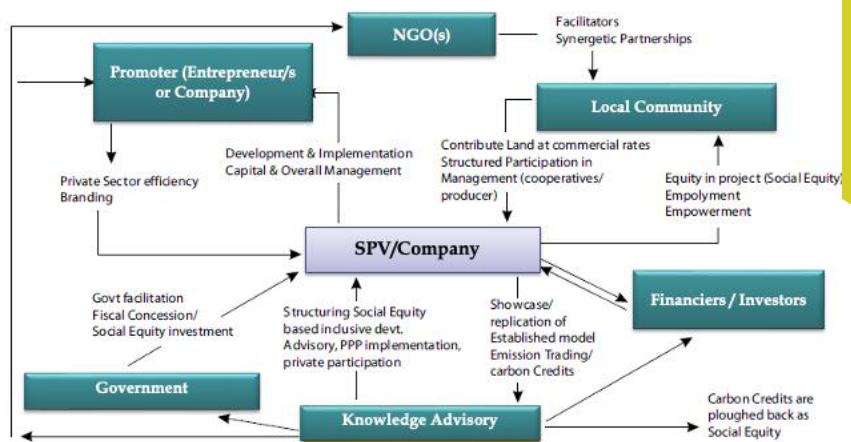
Visiting Faculty, Imperial School of Agribusiness

Independent Consultant & Advisor – PPP and Public Policy

Consultant and Head – Financial Services and Strategic Govt Relations, Plentifarms



Design PPP for Micro and Medium Sector



counts for about 35 percent of the regional crop deliveries in value, mainly in the form of vegetables, flowers, and fruits. Producers usually sell their produce directly to Parisians or at local markets. In Greater London, there are 13,566 hectares of farmland of which 500 hectares are under fruit and vegetable cultivation. Moreover, 800 hectares of public land is used for market gardening. Cities in Russia, Spain, Portugal, the Netherlands, Israel, and many cities in Latin America and Africa also practice urban agriculture.

Urban Agriculture and its Benefits

In Indian context, urban agriculture is beset with severe space constraint challenges and is not likely to make any major difference in the overall food production in the country since this is a mere 5 percent of all urban area and 0.56 percent of all land under agriculture in the country. However this calculation assumes a direct availability of city land under urban areas.

Despite the limitations, urban agriculture in India is worth promoting for several reasons. Firstly, even if the food grown is a small fraction of the total output in the country, a little more of it is welcome, since even this small fraction is bound to provide sustenance to a large number of people. And such small-scale decentralised production can also be done to supplement diets at household or community level. It also has local employment value. Being labour-intensive, it can add to the number of jobs and improve livelihood opportunities in the cities and generate some income, especially for the poor.

Secondly, urban agriculture has a

Urban agriculture can enhance sustainable development, food security and nutrition in urban and peri-urban areas, and nearby rural spaces

significant role in urban environmental management as it can combat urban heat island effects and function as an urban lung in addition to providing visual appeal. Additionally, it brings purposeful recreation that has direct impact on city health. This can be planned under an urban Agritourism development agenda which can even be a commercially attractive proposition for the private sector.

Agritourism Angle

Agritourism can help city-dwellers to establish linkages with nature and educate them in its richness and diversity. Agritourism can provide an opportunity for such engagement and eco-cultural learning. It can also help to develop community bonds and a sense of sharing through community agriculture where people come together and share their stories about their experiences in growing a variety of food.

Further, urban issues with waste management and disposal, urban agriculture can provide some help to deal with it. The use of suitably treated waste

water for urban agriculture can reduce demand for fresh water and help in waste water disposal. Organic waste from the city can be composted and used in food and flower production that can reduce the total quantum of waste and its dumping on land, thereby, reducing the requirement of landfills. It is one of the most advisable forms of waste recycling for cities of the future. This can be synergised with existing government programs on waste segregation and disposal and systems can be linked with Agritourism development planning for urban cities using social equity based PPP.

PPP based Development

Appropriate PPP based project development that includes urban agriculture needs to be taken up under the ambit of decentralized planning. India has the necessary expertise to place such a PPP based strategy.

We are already aware that the forces of climate change are throwing up huge challenges, including floods and heat waves. Besides, droughts in the countryside are likely to trigger greater migration to cities. In this background, a vital addition to municipal functions should be urban agriculture. Similarly, urban planning would require to include urban agriculture as a planning item in its land use plan. The future beckons that urban agriculture does not merely remain a marginal esoteric interest but a critical urban function.

INDIAN BEAN: MULTI-UTILITY CROP FOR TROPICAL REGION

Indian Bean (*Lablab purpureus* (L.) sweet) is an important leguminous vegetable crop grown throughout the tropical world. Commonly known as lablab bean, hyacinth bean, Indian bean, Egyptian bean and *Sem* in Hindi, the legume had its origins in India. It is mainly grown as vegetable, pulse, fodder, green manure and rarely as ornamental plant. The major growing states in India are Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Uttar Pradesh and states of North East India.

Dolichos bean is a good source of protein, thiamine, folic acid, vitamin-E and fiber. Indian bean forms an essential component of sustainable agriculture due to its ability to fix atmospheric nitrogen and to improve the soil properties.

Area and Production

In India, the area under Dolichos bean is 0.90 lakh ha. with a production of 8.1 lakh tonnes and productivity is 9 tonnes per hectare. It is primarily grown as a winter sea-



son vegetable crop due to its photo-thermo tolerance and its manifestations. The bush type dolichos, being photo-insensitive, can be grown in all seasons. In addition to its drought tolerance characters, it has high adaptability to a wide range of production conditions. Flowering plasticity, especially in response to temperature and photoperiod, is a common adaptive feature of legumes in arid and semiarid conditions. Several studies have indicated genetic differences for time to flowering in response to both temperature and photoperiod in annual legumes. Hence, the emphasis was to develop photo-insensitive

high yielding dolichos varieties for different regions and market preference.

Advantages of Indian Bean

In addition to a vegetable/pulse crop, dolichos bean is known to provide up to six tonnes of dry matter/ha. Being palatable to livestock, it is an adequate source of much needed protein and can be utilized in different ways. With this in background, ICAR-IIHR has developed thirteen improved varieties of dolichos bean for different regions and/or market segments. The main attributes of those varieties are photo-insensitiveness,

About the AUTHORS

Dr.M.Thangam, Ph.D., ARS., Principal Scientist (Vegetable Science), Dr.C.Mahadevaiah, Division of Vegetable Crops and Dr. Sanjay Kumar Singh, Director, ICAR-Indian Institute of Horticultural Crops (IIHR), Bengaluru



Improved Varieties in Indian Bean

Bush type dolichos varieties: Arka Jay, Arka Vijay, Arka Sambhram, Arka Soumya and Arka Amogh

Pole type dollicos varieties: Arka Swagath, Arka Krishna, Arka Vistar, Arka Adarsh, Arka Prasadhi, Arka Pradhan, Arka Bhavani and Arka Supriya (Photo-sensitive type)



Arka Krishna



Arka Vistar



Arka Adarsh



Arka Prasadhi



Arka Pradhan



Arka Bhavani



Arka Swagath



Arka Supriya



hence, they can be cultivated throughout the year to get premium price in the market during lean period. The varieties are broadly group into bush type and pole type dolichos.

Seeds availability

The seeds of all the improved varieties released from ICAR-IIHR can be purchased through an online portal (<https://seed.iihr.res.in/>) as well as physically visiting the institute during working days.

Seed production as an enterprise

All the legume vegetables and especially Indian bean is easy for seed production due to its self pollination behavior. Hence, seed production of improved varieties is a profitable enterprise for any aspiring youth. The license for seed production can be obtained from ICAR-IIHR after paying the nominal license fee.

SPACE TECHNOLOGY AND AGRICULTURE

In the early years, under the leadership of Dr. M.H. Mehta, who was the then Vice Chancellor of Gujarat Agricultural University (GAU), the path-breaking initiative, GAU SATKRU was taken up with the help of ISRO. It was the first of its kind and unique satellite based program to reach the smallest farmers.

Satellite Krushi Gosthi : Farmers – Scientists Link

In the year 2000, after several rounds of brain storming and exercises about improving the extension and technology transfer at Gujarat Agricultural University, it was decided to establish GAU Satellite Krushi Gosthi (GAU SATKRU) with one – way video and two-way audio. It was realized that for a big university like GAU (area and spreadwise it was considered the largest in Asia) with 4 main campuses and nearly 65 experimental stations and farms, a facility like this can be a quantum jump in direct communication between farmers and scientists.

“Our enthusiasm was high and the two teams worked hard to meet the deadline of five months which I had set in consultations with Dr. Kasturirangan (Chairman – ISRO) and the local team. It looked difficult in the beginning with the age old bureaucratic system but with the hard work the facility was completed and inaugurated in record time. We named it as GAU Satellite Krushi Gosthi or GAU SATKRU!” recalls Dr Mehta.

A Jump in Communication and Technology Transfer

The direct communication facility proved to be a boon for reaching even corners. As soon as the studio was inaugurated by the Governor of Gujarat in 2001, the direct dialogues brought new dimension.

The very first question was asked by a farmer woman – Bhaniben who lived in a small village near Junagadh(Saurashtra) and who had travelled in a tractor to par-

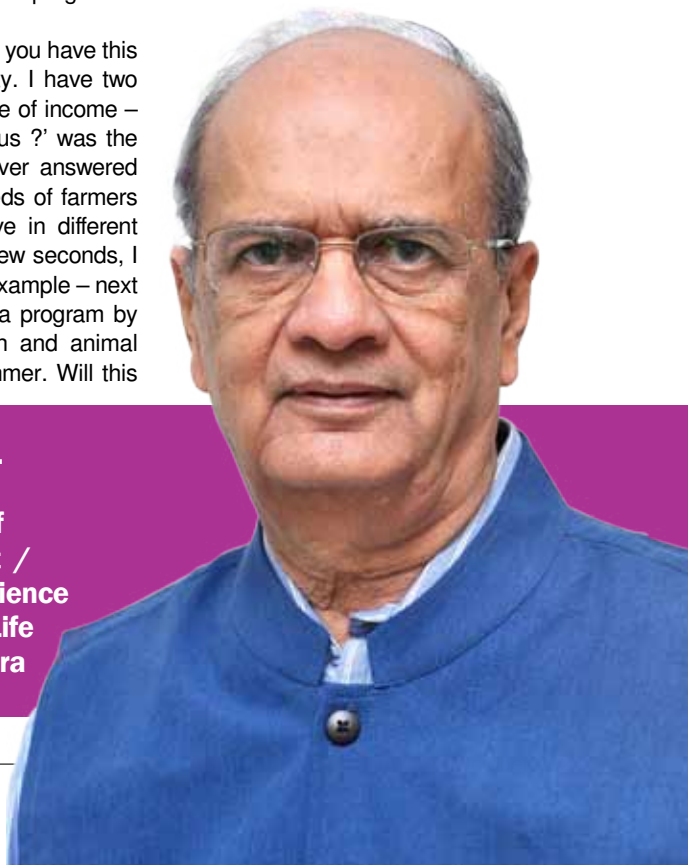


m-krishti was developed as an award winning innovative platform to connect farmers with a variety of stakeholders packaging multiple services through mobile phones by TCS (Tata Consultancy Services)

ticipate in the GAU SATKRU program – more out of curiosity.

“Sir, it is very good that you have this new Antarix (space!) facility. I have two buffaloes – our main source of income – in what way will this help us ?” was the hardest question I have ever answered – and that too with hundreds of farmers and scientists watching live in different parts of the State! After a few seconds, I answered “Bhaniben, for example – next week we have scheduled a program by experts : ‘animal nutrition and animal health’ for the coming summer. Will this

Padmashri Dr. M.H. Mehta, Chairman – Working Group of Eco Agri; President / Chairman – The Science Ashram / Gujarat Life Sciences – Vadodara



be useful to you?" 'Hum...Yes – That will be good. We will look forward to it. Thanks!' I have often discussed this conversation as an example of this technology as a great tool to reach people. Later, the same facility was used to prepare water management plans at different field stations in Narmada Canal areas."

Linking up with marketing yards using GAU SATKRU was another initiative that soon followed .

Over the period of time this experience became a valuable base for appreciating the role of ICT for extension and introducing newer initiatives in Gujarat and elsewhere. Though developments in ICT has been tremendous in the past two decades, an initiative like this showed the way forward of using technology to reach farmers. Some examples :

m KRISHI ICT Platform for 20-20 model

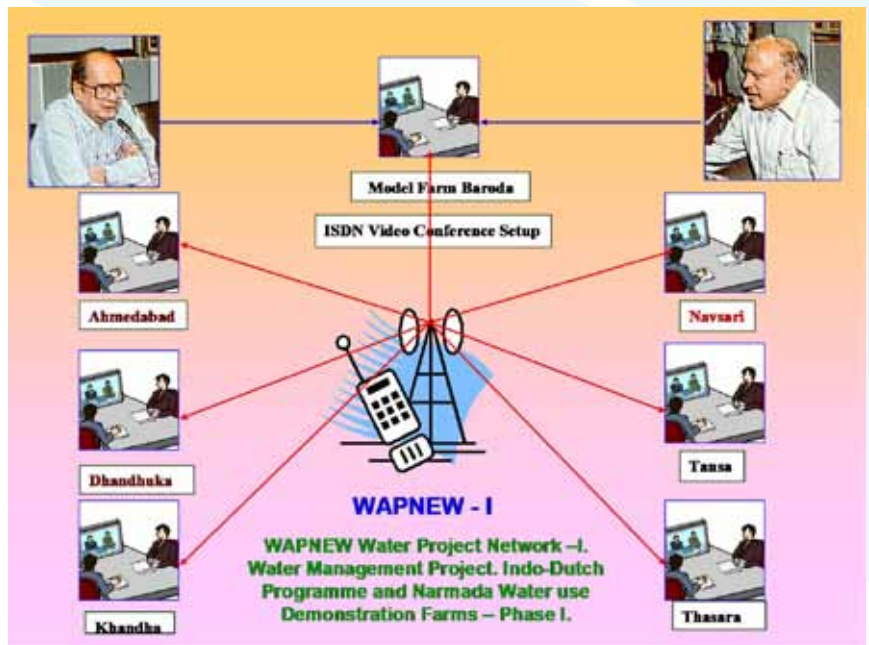
m-krishi was developed as an award winning innovative platform to connect farmers with a variety of stakeholders packaging multiple services through mobile phones by TCS (Tata Consultancy Services). It was introduced commercially in Punjab and UP and started with about 1000 farmers in the first stage and was a great success. Later, it was decided to form a consortia for the 20 – 20 model.

A proposal was worked out for a 20:20 model application for 3 to 4 lead crops like Potato, Castor, Groundnut, Vegetables and fruits for the north Gujarat region. The partners of the consortia would be TCS (Tata Consultancy Services), TSA (The Science Ashram), SOFILWM (Society for Integrated Land & Water Management), NGAPCL (North Gujarat Agricultural Producer Co., and SDAU (Sardar Krushi Dantiwada Agricultural University).

Similarly, in recent years, a program by Solidaridad International for a large number of Soyabean farmers, in Central India, was a big successful example.

Chandrayan – 3 and beyond

The success of Chandrayan – 3 is one of the greatest moments for all of us. It brings a quantum jump in our mission for moving to a developed, stronger and happier country. Some areas of direct



benefits such as defense, education, new generation industries etc ., are obvious. However, in the area of agriculture and food security the space technology will play an increasingly important role. Use of satellites in farming, to identify moisture data, pestilence, cropped area, likely crop yields, crop damage, and insurance company liability – not just in one's own country, but across the world, to keep tabs on likely supply and price trends.

An even more vital use of satellites would be in tracking the weather and likely vagaries of climate change. Can

machine learning or artificial intelligence forecast the likelihood of cloudbursts, floods, forest fires, droughts and heat waves, from the variability observed by satellites in dozens of parameters, apart from giving early warning of these increasingly prolific bearers of havoc ?

"Right from our interactions with ISRO scientists in early years, I have observed these potential applications of space technology for agriculture were always appreciated and emphasized by them in their overall plans. So, I do predict increasingly greater role in the time ahead."

RESHAPING INDIA'S AGRI SECTOR

World's number one and largest Cooperative IFFCO was the first fertilizer manufacturer in the world to successfully introduce nanotechnology-based fertilizer IFFCO Nano Urea Liquid. Established in 2016 IFFCO eBazar Ltd., India's fastest growing agricultural input retail chain wanted to unify its finance operations and drive greater efficiency and productivity. They were able to embrace digitalisation with Oracle's solutions and were able to transform the industry. In conversation with Agriculture Today, Madhulika Shukla, Chief Executive Officer, IFFCO eBazar Ltd. delves deeper into the technology trends in agriculture segment.

Nano Urea liquid and Nano DAP liquid represent significant strides in agricultural fertilisation, promising to reshape farming practices with increase in crop yield



Can you share your views on the recent tech trends that are reshaping the Indian agriculture sector?

In today's rapidly evolving landscape, the agricultural sector in India is experiencing a surge in the adoption of cutting-edge technologies. These innovations encompass precision technologies, such as drones, which are revolutionizing the way we understand and manage land. This includes precise mapping and total land area assessment. AI particularly is making significant inroads in the agriculture sector, focussing on maintaining comprehensive databases of plants and diagnosing plant diseases. Advanced harvesting machines are becoming indispensable tools, enhancing productivity and efficiency for farmers. Notably, IFFCO's groundbreaking invention, Nano Liquid Fertilizer, garners attention. Nano Urea liquid and Nano DAP liquid represent significant strides in agricultural fertilisation, promising to reshape farming practices with increase in crop yield.

Furthermore, the agricultural sector is witnessing the integration of robotics for tasks like harvesting, ushering in a new era of automation. E-commerce platforms have also emerged as a boon for farmers. With better internet connectivity in rural India, knowledge sharing through platforms like WhatsApp and YouTube empowers farmers to make informed decisions with the help of subject experts.

What is the power of cloud-based solutions in the agriculture sector?

Today, farmers can conveniently purchase agricultural products through cloud-based solutions, from daily essentials to inputs.

Cloud-based AI is a game-changer, offering widespread access to weather forecasts and other critical information. Additionally, cloud platforms facilitate information sharing, allowing farmers to showcase their products to a broader market. Cloud collaboration among farmers and agricultural businesses is

Cloud-based AI is a game-changer, offering widespread access to weather forecasts and other critical information.

simplified through cloud technology, which requires no technical expertise to set up. Farmers can connect with organisations that provide cloud services, allowing them to market their agricultural products more effectively.

The power of the cloud computing lies in its availability and cost-effectiveness, particularly in rural India, where technological resources and consultants are limited. Using cloud computing, farmers can access various software solutions and services remotely. Furthermore, embedded AI in cloud solutions enables data-driven decision-making.

How important is cloud as an element in IFFCO eBazar's overall innovation strategy?

Cloud solutions have played a pivotal role in the success of IFFCO eBazar. IFFCO eBazar primarily operates as a retail chain for agri-inputs catering to the needs of rural India.

Traditionally, setting up physical outlets, hiring a workforce, and deploying various software solutions for sales, operations, and inventory management would have been time-consuming and resource intensive. However, with the power of the cloud, we were able to streamline these operations, efficiently.

Geocoding, Geotagging, and face recognition features helped us monitor employee attendance, door access, and security remotely. Furthermore, we transitioned our accounting software from a traditional data centre setup to a server-based cloud service, particularly after encountering a ransomware incident.

Tell us about your specific use of Oracle Cloud-based ERP solutions.

Oracle ERP has significantly enhanced our operations at IFFCO eBazar. As a retail chain agri inputs trading company, we

procure agricultural inputs from various sources. To streamline our supply chain management, we've recently acquired licenses for three modules in Oracle Fusion ERP: Procurement, Inventory and Finance. These modules are seamlessly integrated with Oracle-based in-house developed software, which manages invoicing for all aspects of our business, including sales to farmers, B2B and B2C transactions. This integration allows auto flow of data and ensures that all financial transactions, including sales, purchases, rents, expenses, and collections, are efficiently handled through Oracle ERP. Furthermore, we've integrated Oracle Fusion ERP with GSP portals for the filing of GST returns. In summary, Oracle ERP has revolutionised our operations at IFFCO eBazar, allowing us to efficiently manage our supply chain, financial transactions, and compliance requirements while enhancing overall business performance.

Can you talk about your collaboration journey with Oracle?

The journey has been good, largely attributed to Oracle's product offerings' steadfast support, impressive features, and overall robustness. These factors have facilitated a gradual and extensive integration of Oracle products across ours. Because of the seamless experience with Oracle Cloud ERP, IFFCO eBazar can now embrace automation and new business models to run its business more efficiently and unlock more opportunities to support India's growing agricultural community. Given this, we have placed another order for next product, Oracle Financial Analytics Warehouse (FAW). So, it's been a great experience with Oracle, and we look forward to a fruitful collaboration in the future.

RICE FIELDS TO POTATO ABUNDANCE

THE REMARKABLE TRANSFORMATION OF BARBHUYAN GAON, SONITPUR DISTRICT

Nestled in the heart of Assam's verdant Sonitpur District, within the tranquil embrace of the Sootea Block, lies the village of Barbhuyan Gaon.

For generations, this idyllic hamlet has been a testament to the enduring rhythms of rural life, its landscape dominated by the lush green expanses of rice paddies that stretched as far as the eye could see. Yet, within the past three years, Barbhuyan Gaon has undergone a profound agricultural transformation, a metamorphosis that has breathed new life into its soil, redefined its destiny, and captured the imagination of all who witness it.

Traditionally reliant on rice cultivation as the cornerstone of their sustenance and heritage, the residents of Barbhuyan Gaon have been intimately connected with the land and the ancient art of rice farming. However, like many rural communities across India, they grappled with the trials that often accompany traditional agricultural practices. Limited access to modern farming techniques, unpredictable weather patterns, and the capricious nature of market prices created formidable challenges for these diligent farmers.

Winds of Change

Assam Agribusiness and Rural Transformation Project, affectionately known as APART - a collaborative effort of World Bank became a harbinger of hope for the village.

The inception of the APART Project marked the dawning of a new era for Barbhuyan Gaon. It was a transformation that

The inception of the APART Project marked the dawning of a new era for Barbhuyan Gaon.





transcended the mere adoption of modern farming practices; it was a holistic shift in perspective—a collective realization that the land, too, needed respite and renewal. The first significant shift in this transformation was the deliberate move away from traditional rice cultivation, albeit with a unique twist—a period of fallow fields.

In the embrace of this novel agricultural strategy, Barbhuyan Gaon embarked on a journey of introspection, allowing its fertile land to rest and rejuvenate. This period of fallow fields was more than just a pause; it was a deliberate decision rooted in agricultural wisdom. It was an acknowledgment that the land, like its stewards, required moments of respite to regain its vigor.

Yet, the pivotal moment of this transformation was still to come, guided by Pranab Bhuyan, the Chairman of Jeutia A Garoka Farmers' Producer Company (FPC), a community-oriented collective of ten resolute members.

From Rice to Potato

Under Pranab Bhuyan's steadfast leadership, the village embraced a bold experiment that would forever alter its agricultural landscape—the shift from rice to potato cultivation. This decision was not made impulsively; rather, it was grounded in meticulous research and a deep understanding of the local ecosystem. Potatoes, with their

Potatoes, with their adaptability to diverse soil conditions and the robust demand for them in the market, presented an opportunity, too promising to be ignored.

adaptability to diverse soil conditions and the robust demand for them in the market, presented an opportunity, too promising to be ignored.

In the inaugural year of this audacious shift, Barbhuyan Gaon cultivated more than a hundred bighas of land in partnership with PepsiCo, marking the beginning of a new era. The subsequent year bore witness to an exponential growth as the community expanded its potato cultivation to an astonishing 300 bighas. But the spirit of innovation and resilience showed no signs of slowing down. In the forthcoming year, the community set its sights on an ambitious



goal—more than 500 bighas dedicated to potato cultivation, carving a flourishing path within the former rice-fallow areas.

The results of this endeavour were nothing short of astounding. The once-familiar rice paddies transformed into vibrant potato fields, symbolizing not merely a shift in crops but an evolution in destiny. The potato fields of Barbhuyan Gaon became a testament to the community's faith in change and their unwavering commitment to realizing the potential that lay dormant beneath the soil.

Transforming into a Self-Sustaining Agricultural Hub

The shift to potato cultivation ushered in not only economic gains but also ushered in an era of social development. Families began to reap higher incomes, thanks to the increased profitability of potatoes. This improved financial situation translated into better access to education, healthcare, and improved living standards for the entire community.

This success story, which continues to evolve, transcends the boundaries of Barbhuyan Gaon. It stands as a symbol of rural resurgence, innovation, and the incredible potential that lies within every community. The transformation from rice to fallow fields and then to the resplendent potato fields reflects the resilience and adaptability that defines rural India.

SMART FARMING FOR SUSTAINABLE AGRICULTURE



About the AUTHOR
Prof. Pravat Kumar Roul
Vice-Chancellor
Odisha University of Agriculture
and Technology

The farm sector continues to be the mainstay of economic activities in the developing world and contributes between 1% and 60% of national GDP in many countries across the globe. Today, the global agriculture faces the challenge of producing about 50 per cent more food in order to feed the estimated 9.73 billion world population by 2050. This has created apprehension among the scientists and policy makers whether the conventional farming methods may be adequate to meet this demand. The need of the hour is to adopt appropriate and efficient technologies in the sector that can address these urgent concerns. By harnessing the power of data, automation & connectivity; smart agriculture can revolutionize production, management and distribution of food globally.

By harnessing the power of data, automation & connectivity; smart agriculture can revolutionize production, management and distribution of food globally.

Smart Agriculture

Smart agriculture refers to the usage of technologies like Internet of Things (IoT), artificial intelligence (AI), sensors, robotics, location systems and communication systems for increasing the quality and quantity of farm produce while optimising the resources availability. These technologies work in



collaboration to provide farmers with real-time information on soil health, weather patterns, crop conditions and livestock well-being. The IoT is the mechanism that provides connectivity among all these technologies – between sensors and machines, which generate high magnitude and complex data at farm level. The farm is precisely managed based on the data received.

Smart farming integrates digital and physical infrastructure by using drone technology, Internet of Things; GIS, remote sensing, artificial intelligence, GPS and other technologies. Sensor based automated irrigation practices help farmers to monitor agricultural land, temperature, soil moisture, etc., which conserves a significant quantity of water that would otherwise be needed for irrigation. The data collected through sensors on weather, soil moisture and crop health at real time help the farmers to take informed and prompt decisions about when, where and how much to fertilize and spray pesticides.

Data Driven Agriculture

Information technology has witnessed many transformations in last three decades and has applications in many areas from agriculture and rural development to the space. With the advent of advanced technological innovations in every discipline of science, huge data are generated which are higher in magnitude and complex in nature. Agriculture and allied sciences are also data driven science associated with huge data starting from planting to production as well as process of varietal development, which plays a decisive role in crop, animal and fish production. During the 21st century, agriculture and allied sectors are also witnessing technological transformations and challenges. Out of many technological innovations and adaptations, high end computation is essential for storing, analyzing and generating information useful for taking decisions to increase farm produce in sustainable manner.



Precise Management

Precision agriculture aims to improve the spatial and temporal management practices in a farm. It involves tailoring the cultivation process to specific areas within a field. The exact amount of inputs required is determined by analyzing soil and crop data thereby reducing wastage of fertilizers and pesticides. The resource use efficiency is enhanced as the farm is managed precisely on real-time basis.

Real Time Monitoring

Drones and satellites help to monitor crop health and detect problems early at different locations. Sensors used for measuring soil moisture and weather forecast made for farmers by use of satellite data help them to decide the best time for sowing, irrigating and harvesting. The plot-wise fertilizer need can be assessed through sensors, which increases the nutrient use efficiency and reduces the cost and environmental damage. As the farmers are able to monitor their crops 24/7 with so much data in their hands, it becomes easy for them to detect problems and take corrective measures in real time. Adoption of smart agriculture helps in reduction of soil degradation, less use of agro-chemicals and minimizing environmental pollution; thereby making agriculture sustainable.

Streamlining

The IoT is the mainstay of smart agricultural technology. IoT devices and sensors are deployed across farms to collect data related to soil moisture, temperature, humidity, crop conditions and more. This

data is transmitted to central systems for analysis and interpretation, which enables farmers to adjust irrigation and fertilizer application precisely. Big data in agriculture are employed to handle the information obtained from drones and other measuring instruments and the IoT integrate all these information to optimise all stages of the production process.

Collaborative Participation

Governments, research institutions and industry players play a crucial role in driving research, development and adoption of these technologies. Adequate infrastructure, capacity building and training are to be provided to use the technology effectively. Further, concerns about data security and privacy must be addressed to ensure that sensitive data is protected. The initial investment cost of implementing smart agriculture can be a barrier for developing countries and small farmers. Hence, there is a need for development of localized technology. Adequate infrastructure, capacity building and training are to be provided to use the technology effectively. Further, concerns about data security and privacy must be addressed to ensure that sensitive data is protected.

Smart farming technology is considered to be very important as it is reshaping the agricultural sector by infusing it with innovation and technology. As the world population continues to grow, the adoption of smart agriculture practices becomes not just a choice but a necessity, to ensure global food security while safeguarding our resources.



UNVEILING THE QUANTUM FRONTIER IN AGRICULTURE

A JOURNEY INTO THE PROMISE AND POWER OF QUANTUM COMPUTING

Touted as the next revolution in computation, quantum computing has the potential to solve complex problems that are currently beyond the reach of classical computers.

Quantum computing derives its power from the principles of quantum mechanics. Unlike classical computers, which use bits to represent information as 0s and 1s, quantum computers utilize quantum bits or qubits. Qubits can exist in a state that is a combination of 0 and 1, thanks to a phenomenon called superposition. This unique property enables quantum computers to perform multiple calculations simultaneously, vastly increasing their computational capacity.

From optimizing crop yields to tackling climate change-related issues, quantum

computing promises to be the plough that furrows a path towards a more sustainable and prosperous agricultural future.

Seeding the Quantum Revolution: Understanding Quantum Computing's Role in Agriculture

Imagine optimizing the irrigation systems of a vast agricultural estate to conserve water while ensuring each crop receives the ideal amount. Classical computers would struggle with the number of possibilities, but quantum computers could simultaneously evaluate numerous scenarios to determine the most efficient strategy.

Crop Optimization: The Quantum Farmer's Almanac

One of the most promising applications of quantum computing in agriculture lies

in crop optimization. Quantum algorithms can analyze data about soil composition, weather patterns, and crop genetics to fine-tune planting times, irrigation schedules, and fertilization practices. This can lead to higher yields, reduced resource usage, and minimized environmental impact.

Moreover, quantum simulations can model intricate biological processes, allowing for the development of drought-resistant, disease-resistant, and higher-nutrient crops. By rapidly exploring different genetic combinations, quantum computers can fast-track the breeding of improved crop varieties, ensuring food security in the face of changing climates.

Climate Modelling and Prediction: Navigating Agricultural Resilience

Quantum computing's prowess can

About the **AUTHORS**



Monendra Grover, Dwijesh Mishra, Krishna Kumar Chaturvedi and Girish K. Jha
Division of Agricultural Bioinformatics, ICAR-Indian Agricultural Statistics Research Institute

aid in creating highly accurate climate models, enabling farmers to anticipate shifts in weather and adapt their practices accordingly.

Quantum algorithms can analyze a myriad of variables, such as temperature, humidity, and wind patterns, to predict weather conditions with unprecedented accuracy. This information can guide farmers in making informed decisions about planting, harvesting, and resource allocation, mitigating potential losses caused by unpredictable weather.

Supply Chain Optimization: Farm-to-Fork Efficiency

By optimizing the logistics of transporting produce from farms to markets, quantum algorithms can reduce food waste, energy consumption, and overall costs. Additionally, quantum-powered simulations can model supply chain scenarios, accounting for factors such as transportation routes, storage conditions, and demand fluctuations.

Challenges and Cultivating Collaboration

Quantum hardware's sensitivity to noise and environmental interference can impact the accuracy of calculations. However, as technology evolves, these challenges are likely to be overcome through error-correction techniques and refined algorithms.

For quantum computing to truly plough through agricultural challenges, collaboration between experts in quantum physics, computer science, and agricultural sciences is paramount. Governments, research institutions, and agribusinesses must join forces to harness the potential of quantum computing in agriculture.

Quantum Computing's Role in Bioinformatics

With the ability to process complex biological data at unprecedented speeds, quantum computing promises to unravel the mysteries of genetics, accelerate drug discovery, and pave the way for groundbreaking medical advancements.

One of the most promising applications of quantum computing in agriculture lies in crop optimization.

Bioinformatics is the art of translating the vast sea of biological data – from DNA sequences to protein structures – into meaningful insights. Traditionally, this involves heavy computational processing that can take years for classical computers to complete. Enter quantum computing, where the rules of quantum mechanics allow for a mind-bending computation speedup.

Consider the challenge of protein folding – a fundamental mystery in biology. Proteins, the workhorses of the cell, adopt intricate three-dimensional structures that dictate their functions. Determining a protein's native shape is computationally intensive and vital for drug design and disease understanding. Quantum computers have the potential to simulate these processes with incredible accuracy and speed, revolutionizing our understanding of life at the molecular level.

Genetic Sequencing and Quantum Acceleration

Genetic sequencing, a cornerstone of modern biology, involves decoding the sequence of DNA bases that make up an organism's genome. Quantum computing's parallel processing capabilities can accelerate this process exponentially. The algorithmic prowess of quantum computers allows for rapid comparison of DNA sequences, identifying genetic variations that contribute to diseases and providing a comprehensive view of an organism's genetic makeup.

Biological Data Compression and Quantum AI

As the amount of biological data grows exponentially, efficient data storage and

analysis become paramount. Quantum computing has the potential to revolutionize data compression and storage, enabling scientists to store vast amounts of genetic and molecular information in a compact and easily accessible format. Additionally, quantum machine learning algorithms can mine massive biological datasets for hidden patterns, facilitating the discovery of new biomarkers, diagnostic tools, and therapeutic targets.

Quantum Biology Meets Quantum Computing

Quantum biology delves into the enigmatic role of quantum phenomena in biological processes, unveiling the subtleties of photosynthesis, enzyme reactions, and more. On the other hand, quantum computing harnesses quantum mechanics to revolutionize computation, offering the potential to unravel complex biological data and accelerate drug discovery. As these frontiers intersect, a new chapter unfolds – one where the quantum realm meets the intricate tapestry of life, promising breakthroughs that challenge our perceptions of both biology and computation.

The Road Ahead: From Theory to Reality

While quantum computing is still in its infancy, it's progressing at a remarkable pace. As researchers continue to refine hardware, software, and algorithms, we inch closer to unlocking the full potential of quantum computers. Governments, academia, and industries are investing heavily in quantum research and development, recognizing the transformative impact it could have on various sectors.

As we navigate this uncharted territory, collaboration between physicists, computer scientists, mathematicians, and domain experts will be pivotal. The challenges are immense, but so are the rewards. Quantum computing holds the promise of revolutionizing industries, solving problems previously deemed unsolvable, and reshaping the boundaries of what is possible in computation.

CONSERVATION OF AGRO-BIODIVERSITY AND NUTRITION SECURITY

An FPO Initiative

Amit Verma, an engineer and a management graduate, took up farming during the COVID-19 and constituted the 'Rampur Krishak Farmer Producer Company Limited (RKFPCL)' in the year 2020 in the Pasiyapur Janoobi village in Uttar Pradesh. An FPO which presently has more than 5000 farmers as its members, facilitated the transformation of 788 ha of degraded land into a haven of agro-biodiversity while linking itself with the Integrated Child Development Services (ICDS) Scheme.

Integrating Agrobiodiversity, Community Nutrition and Economics

As an innovative step, the FPO, decided to link the conservation of agro-biodiversity and improving the economic condition of the farmers, to providing nutrition to the malnourished children by consuming produce cultivated locally by the farmers. Therefore, as per the nutritional requirements and demand presented by the ICDS department officials, the FPO encouraged small and marginal farmers in their area, to produce a variety of traditional crops, vegetables and oilseeds through organic and natural farming techniques instead of practicing mono-cropping.

Gradually, under the FPO's umbrella, the farmers, SHGs and youth of the village started preparing nutrition kits or Sanvardhan 'Poshan Kits' through various in-house operations under the 'Rampur Krishak' brand, utilising the agricultural produce cultivated by the farmers. These kits are eventually purchased by the Panchayats as per the guidelines under the 15th financial commission and distributed to women and



As an innovative step, the FPO, decided to link the conservation of agro-biodiversity and improving the economic condition of the farmers, to providing nutrition to the malnourished children by consuming produce cultivated locally by the farmers

children as per their nutrition requirements. This initiative is a collaboration between ICDS, FPO and the Gram Panchayat.

In fact, in the 3rd year of its operations, the FPO had earned a turnover of approximately INR 2.25 Crores which not only improved the economic conditions of the farmers but also encouraged other farmers to cultivate a wide variety of produce and collaborate with the FPO.

Genesis

Amit Verma and his team, inspired by the natural farming practices adopted by Padma Shri awardee Sri Bharat Bhushan Tyagi and encouraged by the local administration, decided to form an FPO under his

mentorship with the objective to facilitate sustainable agricultural practices in the village while the reviving agro-biodiversity and restoring natural resources. However, there was a need for a definitive plan and financial support since the team needed to link sustainable agriculture practices to nutritional security and economic upliftment of the farmers and their families as well. The team then visited and consulted with officials from various government departments such as Niti Ayog and Central and State Department of Health & Family Welfare ICAR and AIIMS.

After the consultation process and substantial secondary research, the team zeroed in on the ICDS scheme where the

guideline stated that they would be compensated for providing good quality nutrition kits to women and children.

Motivating Farmers

It was a challenge for the FPO to convince the farmers to shift to multiple cropping practices and natural farming as the farmers were hesitant. Therefore, the FPO assured them through numerous field visits and discussions that if they cultivate the requested produce, the FPO would purchase the same from them at MRP instead of MSP and that the farmers would not only gain economically but also in terms of nutrition by consuming the variety of produce. The initiative began with 4 farmers growing mushrooms in their rooms. Thereafter, once the FPO purchased the produce from them, these farmers were encouraged to produce a variety of crops in their fields as requested by the FPO.

Eventually, as the word spread and more and more farmers joined the FPO. They were organized into clusters by the FPO members who encouraged them to now cultivate 'dalhan and tilhan' which means local varieties of pulses and oilseeds on their lands. They then further diversified into producing traditional varieties of millets, various vegetables, medicinal plants and fruits. They also started producing honey which was to be used as a by-product in the nutrition kit or the Sanvardhan 'Poshan kit'. The produce was purchased from the farmers with monetary assistance from NABARD, who eventually also helped in building a chain of cold storage and storage silos on the fields of farmers and with the FPO.

Additionally, the associated farmers gradually transitioned to natural inputs such as cow dung, leaves and leaving the residue on the fields to supply nutrients to the soil instead of using chemical inputs.

Processing

The FPO engaged local SHGs and local youth for the primary and secondary processing of the produce to prepare the kits as required by the ICDS officials. The SHGs were also provided with solar powered machines at their homes at a highly



As an added benefit, the percentage of severely wasted children in Rampur has come down from 5.9 (NFHS 5) to 2.2 as per the Poshan tracker app.

subsidized rate. The kit mostly comprises products such as cookies, porridge, honey, amla juice, mushroom veg corn soup, amla sweet and salty candy etc., which are generally prepared from organic honey, sesame, ghee, oyster mushroom, corn, dry fruits, black wheat, moringa, coarse grains including millets etc.

Approximately 95 per cent of these raw materials are purchased from the farmers at MRP and the rest are purchased from the market or imported from other states such as dry fruits, salt etc. The FPO also facilitated quality certification for the products from FSSAI, who further provided training to the farmers, SHGs and youth in good manufacturing practices. The manufacturing process and products are further certified under the National Accreditation Board for Testing and Calibration Laboratories (NABL), Food Safety Management System (FSMS) and Quality Management System (QMS).

Impact

Approximately, 8500 farmers across the states of UP, Maharashtra and Telangana are now linked to the FPO and most of

them are gradually transitioning towards sustainable agricultural practices coupled with multiple crop production comprising varieties of oilseeds, millets, vegetables, medicinal plants, fruits, honey and fungi. The income for FY 22-23 was approximately INR 2.25 crores for the FPO.

The income of 1700 farmers in Rampur itself has doubled since in addition to purchasing their produce at a higher market rate, approximately 20 per cent of the profit is also distributed amongst the members of the FPO. More than 788 ha of degraded land in Rampur has now been restored with soil cover that is rich in nutrients and microbes. The groundwater and surface water levels have also shown remarkable improvements.

As an added benefit, the percentage of severely wasted children in Rampur has come down from 5.9 (NFHS 5) to 2.2 as per the Poshan tracker app.

Awards and Recognitions

ICAR has presented the FPO with the 'Best Emerging FPO' award in the year 2021. The FPO has also been awarded by the Chief Minister as the 'Best FPO' and the Honorable Governor presented the FPO with the 'Innovative Agriculture' in the year 2022. Further, Niti Ayog has included the FPO under the 100 top FPOs in India 2022. PM awards for excellence of public administration. Additionally, the initiative taken by FPO, ICDS and district administration called 'Sanvardhan, Suposhit Rampur- Ek Pahal' has been presented with the PM Award in the 2023

STRENGTH OF AGRI FINANCE

What is the coverage of institutional finance in agri credit?

Kotak Bank has a focused business unit that caters to institutional credit for agriculture. This business lends for all agri related activities starting from cultivation, pre/post cultivation activities, procurement, warehousing & distribution, trading grading & sorting and finally to primary & secondary processing activities that ensure full value addition along the agri value chain. This business now has grown to advances in excess of Rs.20,000 Crore. The strength of this coverage is that it caters to multiple segments like food and cash crops, allied agri and distribution. The primary criterion is to fund for any activity linked to agri related segments which is being done as a business. Hence we call it as Agri Business Group. This to differentiate from lending for subsistence agriculture or livelihood agriculture which has been the bulk of lending by institutions focused on retail agri lending .

What do you think has helped in the improved coverage of institutional credit?

Since the last 2-3 decades, with India getting to be self-sustaining in most agriculture output and even becoming the top 5 exporters of many agri commodities, there is need for focused coverage to understand the need for organized credit of larger sizes to various clients along the agri value chain like large farmers, agro processors, commodity traders and exporters apart from setting up agri infrastructure facilities. Also in-

B.S. Sivakumar, President and Head – Agri Business Group, Kotak Mahindra Bank Ltd.

stitutional credit focuses equally on asset creation and working capital unlike the traditional crop loans. Similarly the improved institutional credit also attempts to offer specialized lending facilities to mirror the seasonal credit needs, allow trade products for exporters and develop credit evaluation capabilities for assessing the risks related to activities like horticulture, poultry, organized dairies, pledge financing for seasonal bridge finance to farmers and processors to hedge against price risks and benefit from not having to do distress sale of their output.

At the policy level, what changes have happened in improving access to credit for farmers?

The key change was when the RBI as regulator allowed for increasing credit limits to the agri sector under the PSL norms and brought in recognition for lending to participants along the value chain who help farmers create storage and distribution facilities, market linkages and recognized the need to increase scale of activities that qualify for PSL.

What are the challenges of financial institutions in agri credit lending?

The pricing of institutional agri credit has not factored the risk to reward ratio due to the desperate need to meet PSL targets. This results into banks pricing such facilities at very fine rates without accounting for the credit & distribution costs. The incremental costs for reaching to deep semi urban and rural pockets and the cost of recovery of the loans act as barriers for scale-up of the activities. Further the sector continues to have substantial cash handlings which necessitates need for local branch reach and costs for cash disposal due to seasonal cash imbalances. The segment is also prone to the risks of commodity price movements due to natural causes, domestic and international demand and supplies and most importantly it is prone to regulatory and political regulations that come suddenly.

How has digitization helped in



Digitisation has significantly improved the possibilities to go deep into the hinterland as online payments reduce cash dependence.

improving agri credit?

Digitisation has significantly improved the possibilities to go deep into the hinterland as online payments reduce cash dependence. Also online disbursement and recovery mechanism has reduced delay in collection reconciliation and reduced the risk of theft and employee frauds inherent of cash handling. It also affords granulation of transactions without the need for local manpower presence. Further digital onboarding of client data for credit assessment and digital documentation for loan disbursement has reduced the turn around time for loan delivery to the customer.

What are the financial products from Kotak for agri sector and how has been the response of farmers to it?

Kotak's agri credit business has been in existence for 20 years now and has

developed the knowledge and expertise to identify the target segments of farmers and entrepreneurs along the agri value chain who exist in each region of our country given the diversity of activities. The division has all requisite products and facilities and we cater to a cross section of customers along with various ticket sizes. The products include short medium and long term facilities, fund and non fund limits and a whole host of products that are unique to this segment. The business also is a leader in funding under the various schemes promoted by the government both at the central and state levels that are aimed at benefitting the various customer segments.

What are future products/plans of Kotak in agri segment?

The focus of the division is to continue to digitize its products, speed up the delivery mechanism and use automation for credit assessment and minimize the delinquency of the portfolio considering that agri credit has long been associated with higher risk to lenders. The sector is key in our country's GDP growth and it has evolved with time with more capital investments and automation, higher value addition and identification of new international markets to venture into. Our business tracks these developments to help grow our portfolio.

CROP HEALTH MANAGEMENT FOR SUSTAINABLE AGRICULTURE



Indian agriculture and allied activities have reached great heights in the recent past with the success of green revolution, white revolution, yellow revolution and blue revolution. However, to feed the burgeoning population of the country, which has now become the largest in the world, a productive, competitive, diversified yet sustainable agricultural sector is needed at an accelerated pace. Abrupt changes in regional and global climates have led to various biotic and abiotic stresses delimiting agricultural production and hence crop health management is of paramount importance to safeguard the food security. The challenge is to design Good Plant Protection Practices (GPPP) that will be sustainable to ecosystems as well as people's health.

Sustainable Agriculture: Status and Recent Trends

For decades, particularly after green revolution, food has been produced through intensive and commercial farming in India

Abrupt changes in regional and global climates have led to various biotic and abiotic stresses delimiting agricultural production and hence crop health management is of paramount importance to safeguard the food security

damaging our soil, water, air, and climate. Hence it is high time we moved towards a farming system that is more sustainable—environmentally, economically and socially. Sustainable agriculture highlights crop rotation, micro irrigation, live mulching, integrated pest management (IPM), conservation agriculture, agroforestry, biodynamic and organic farming, integration of livestock and crops, permaculture etc.

In the last decade or so, there have been significant changes in Indian agriculture and many new technologies have been introduced to boost farming sector. Several



About the AUTHORS
Sumitra Arora (Principal scientist), Licon Kumar Acharya (Scientist)
ICAR-National Research Centre for Integrated Pest Management



new-age farmers are opting for new age technology such as Hydroponics and Vertical Farming, precision agriculture, soil mapping software to know the nutrient status of farm land, agriculture drone technology, machine learning (ML), artificial intelligence (AI), etc. These technologies will increase crop produce and will be the flag bearers of future to attain sustainability as well as food security.

Crop Health Management for Sustainable Ecosystem

Quality seeds of adapted varieties

To achieve healthy crops, it is essential to deploy healthy seeds and propagating materials which are free from pathogens. The planting material should be resistant to predominant and emerging pests and adapted to changing, harsher climatic conditions.

Healthy soil

It is important to maintain soil biodiversity by agro ecological approaches that help to keep soils covered, diversify crop patterns, reduce soil disturbance and, thereby improve soil health. The diverse population of soil organisms support plant health through the interaction of pests with their natural enemies. Healthy soils greatly contribute to growing healthy plants.

Maintaining agricultural biodiversity

Multiple cropping systems, such as agroforestry, intercropping, or legume-based agricultural systems, have a higher species diversity than monocropping. This increased species diversity could lead not only to a more efficient use of resources – namely, soil, water, nutrients and light – but could also help to curb and control pests.

Integrated Pest Management (IPM)

Healthy plants constitute the foundation of food security and are key to sustaining life on earth. Currently, up to 40 percent of global crops are lost to pests, primarily insects, diseases and weeds. Application of broad-spectrum pesticides to manage pests negatively affects beneficial organisms that are fundamental to ecosystem services and nature-based pest management. Hence, the integrated pest management (IPM) technique which focuses on prevention is the viable alternative to tackle the issue.

Timely actions and intervention like, preserving biodiversity, imposition of strict quarantine, developing climate resilient varieties, forecasting and early warning system, etc. are the need of the hour to achieve the goals of sustainable agriculture.

IPM refers to the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human and animal health as well as to the environment. IPM comprises of various components such as,

■ **Monitoring:** Under IPM practices, continuous monitoring of crop health and pest status including natural enemies is the fore-most component.

■ **Cultural:** Use of resistant varieties, Crop rotation, trap cropping or border crop, right time of sowing the seeds to escape the time of pest attack, proper plant spacing, push and pull technology to repel and attract the pest, respectively.

■ **Mechanical:** Removal and destruction of egg masses, larvae, pupae and adults of insect pests, uprooting and destroying the virus infected plants, uprooting the weeds, use of light and pheromone traps for monitoring and pest management.

■ **Biological:** Use of predators such as species of spiders, dragon flies, damsel flies, lady bird beetles, *Chrysopa sp.*, birds etc. The parasitoids like species of *Trichogramma*, *Apanteles*, *Bracon*, *Chelonus*, *Brachemeria*, *Pseudogonotopus* etc. are being used. *Pseudomonas* and *Trichoderma* are also used for seed and



soil treatment.

■ Chemical:

● **Biorational pesticides:** These include use of oils, botanicals, insect growth regulators and microbial pesticides. Microbial pesticides comprises of major share and includes fungi (species of *Hirsutella*, *Beauveria*, *Nomurae* and *Metarhizium*), nuclear polyhedrosis virus (NPV) and bacteria (*Bacillus thuringiensis* (B.t.) and *B. papillae*) which can infest and kill large number of insects in the fields.

● **Conventional Synthetic pesticides:** Need based application of recommended chemical pesticides which can kill or inactivate pest on contact, if the pest population crosses the economic threshold level (ETL).

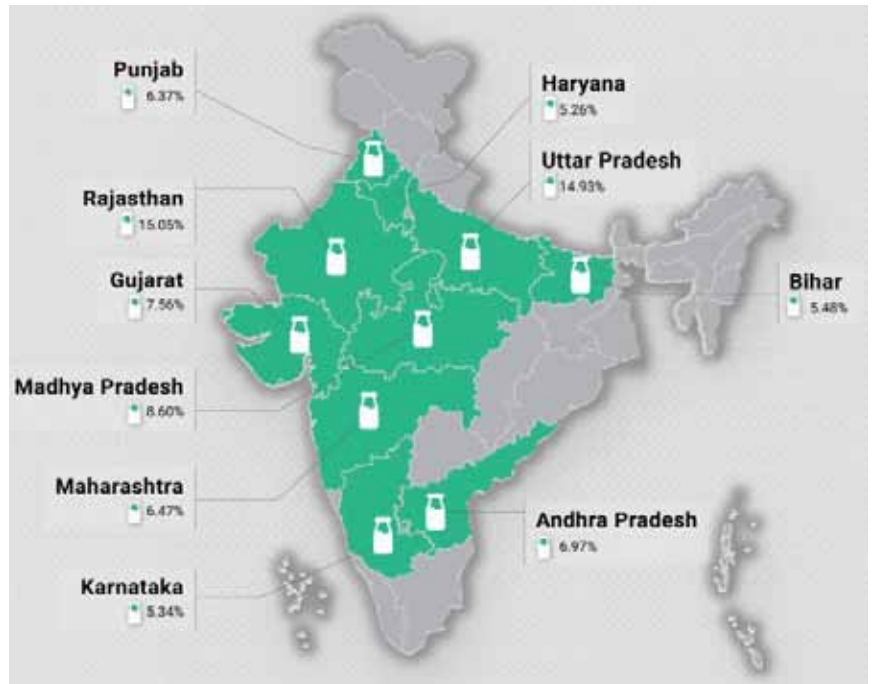
The Way Forward

Climate change poses a great threat to crop health and thereby food security and sustainability. Alterations in weather conditions and climate change weakens our ecosystems and gradually leads to biological changes in pests and also impact physiology and structure of host thereby increasing vulnerability of plants towards biotic and abiotic stress. Timely actions and intervention like, preserving biodiversity, imposition of strict quarantine, developing climate resilient varieties, forecasting and early warning system, etc. are the need of the hour to achieve the goals of sustainable agriculture.

THE NEED OF HOUR: WHITE REVOLUTION-II

Dairy industry employs more than 80 million rural households out of which 70% are small and marginal farmers who own 33% of the land and 80% of livestock asset generating one third of their gross income. Increasing productivity of breeds of milch animals will therefore be key for profitable and sustainable dairy farming.

India's milk production has increased by 51% over the past eight years, between 2014-2015 and 2021-22, to a total of 2,22,006 million tonnes in 2021-22. The milk production increased by 5.29% in 2020-21 compared to the previous year. Rajasthan (15.05%), Uttar Pradesh (14.93%), Madhya Pradesh (8.6%), Gujarat (7.56%), and Andhra Pradesh (6.97%) are the top five milk-producing states. Together, they contribute 53.11% of the nation's total milk production.



Need of white Revolution II in India:

Today, as the challenges faced by the dairy industry continue to evolve, there is need for a renewed focus and revitalization, often referred to as White Revolution II. White Revolution II will emphasize on the adoption of advanced technologies and innovation to optimize milk production, enhance animal health, and streamline supply chains. Technologies such as artificial insemination, genetic selection, automated milking systems, and IoT-based monitoring can revolutionize the way dairy farming is practised. Integration of these technologies will not only increase productivity but also lead to improved animal welfare and sustainable farming practices.

White Revolution II and Sustainability

Sustainability is a key concern in the



About the AUTHOR
Mahadev Trimbak Kakade,
Chief Manager (Research),
State Bank Institute of Rural
Banking, Hyderabad

India's milk production has increased by 51% over the past eight years, between 2014-2015 and 2021-22, to a total of 2,22,006 million tonnes in 2021-22

modern world, and the dairy industry can adapt to meet these expectations. White Revolution II will place a strong emphasis on sustainable practices in milk production, processing, and distribution. It encourages the implementation of eco-friendly initiatives like waste management, water conservation, and renewable energy adoption. Sustainable dairy farming practices not only protect the environment but also improve the

Agriculture & Allied and Livestock Sector share in GVA (In crores):

At Current Prices					
Year	GVA (Total)	GVA (Agriculture & Allied)		GVA (Livestock Sector)	
		Amount	% Share to total GVA	Amount	% Share to total GVA
2015-16	1,25,74,499	22,27,533	17.7	5,82,410	4.6
2016-17	1,39,65,200	25,18,662	18.0	6,72,611	4.8
2017-18	1,55,05,665	28,29,826	18.3	7,85,683	5.1
2018-19	171,75,128	30,29,925	17.6	8,82,009	5.3
2019-20	183,55,109	33,58,364	18.3	9,77,730	5.2
2020-21	180,57,810	36,09,494	20.0	11,14,249	6.2

Source : National Accounts Statistics-2022, Central Statistical Organisation, GoI

overall image of the industry and meet the growing consumer demand for ethically produced dairy products.

White Revolution II will focus on empowering farmers by providing them with access to training, resources, and credit facilities. In an era where food safety and quality standards are paramount, White Revolution II aims to bolster the dairy industry's efforts in these areas. The implementation of stringent quality control measures, adherence to international standards, and proper traceability systems will instil confidence in consumers.

Challenges of the White Revolution II in India:

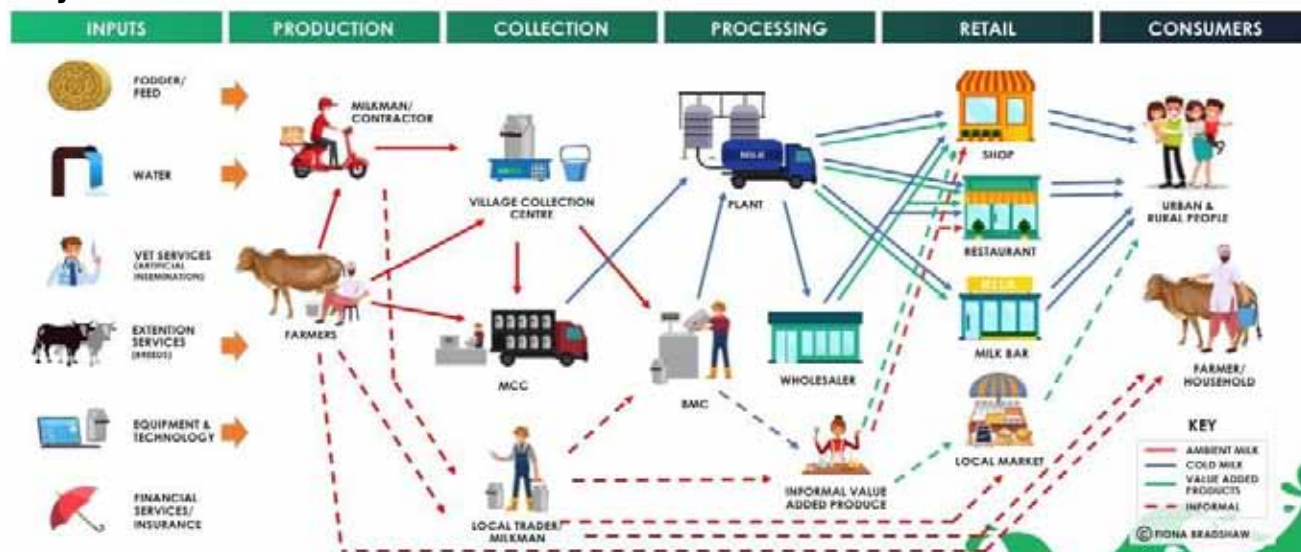
Implementing a White Revolution II would require comprehensive planning, coordination, and continuous evaluation to address the challenges effectively and achieve the desired outcomes.

Financial institutions and White Revolution II

Financial institutions (FI) can play a critical role in ushering in India's second white revolution in the dairy sector. Banks/FIs have significant opportunities to finance the entire milk value chain, encompassing farmers, milk collection and transportation, dairy processing, packaging and distribution etc. By

CHALLENGES	SUGGESTIONS TO OVERCOME IT
Infrastructure Development	Overcoming this challenge would involve collaboration between the government and private sector to allocate resources, streamline logistics, and incentivize investments in infrastructure development.
Technology Adoption	Encouraging technology transfer through training programs, subsidies, and research partnerships would be crucial to overcoming this challenge. E.g IDA, NDDDB and State Dairy Development Departments
Farmer Education and Empowerment	Farmer education programs can be conducted to enhance their understanding of best practices in cattle management, milk production, and business management. e.g., KVKs
Quality Assurance and Food Safety	Establishing robust regulatory frameworks, implementing stringent quality control measures, and promoting certification programs can help overcome this challenge.
Market Access and Diversification	Creating linkages between dairy farmers, processors, and retailers can facilitate market integration. Promoting value-added dairy products can help tap into new markets and increase profitability.
Environmental Sustainability	Promoting sustainable farming practices, such as efficient water usage, waste management (Biogas Plants, Manure etc) and renewable energy adoption (Solar), can contribute to environmental conservation.

Dairy Value Chain





providing credit facilities, banks can support farmers in acquiring livestock, fodder, and equipment, ensuring sustainable milk production. They can also finance the establishment of milk collection Centres, transportation vehicles, and cold chain logistics to facilitate efficient and timely milk procurement.

Digital financing to Dairy Farmer

State Bank of India (SBI) is a pioneer in digital financing to the dairy farmer through Yono Krishi Safal Dairy Loan digital banking platform which offers dairy farmers a convenient and user-friendly interface for applying for loans, removing the need for lengthy paperwork and time-consuming procedures.

Technology in dairy farming:

Automated Milking Systems: Technology has streamlined the milking process, reduced manual labour and increased efficiency. These systems can monitor individual cow health, milk yield, and even identify potential issues early on.

Precision Feeding and Nutrition: Advanced technologies enable precise monitoring and control of feed formulations, ensuring optimal nutrition for each cow based on its specific needs.

Data Analytics and Monitoring: Sensors and monitoring systems

By providing credit facilities, banks can support farmers in acquiring livestock, fodder, and equipment, ensuring sustainable milk production.

are used to collect real-time data on various parameters such as milk yield, rumination, body temperature, and activity levels.

Cow Comfort and Welfare: Automated cooling systems, barn climate control, and robotic grooming devices help maintain optimal conditions for cows, reducing stress and promoting better overall health.

Reproduction and Genetic Selection: Technologies like artificial insemination and embryo transfer have facilitated efficient breeding programs, enabling farmers to select high-quality genetics for improved milk production and disease resistance. Genetic testing and genomic selection further aid in identifying desirable traits in breeding stock.

Farm Management Software: They help track inventories, monitor financials, analyse performance, and optimize resource allocation, enabling more effective decision-making.

Government Initiatives in Dairy Development:

To encourage infrastructure development, the state governments have introduced a number of investment incentives.

Following are some government programs: –

- Dairy Processing and Infrastructure Development Fund
- Animal Husbandry infrastructure development fund
- National Programme for Dairy development
- Pradhan Mantri Kisan Sampada Yojana
- Kisan Credit Cards (KCC) to Livestock Farmers
- Rashtriya Gokul Mission
- National Livestock Mission
- AHIDF Animal Husbandry Infrastructure Development Fund.

By embracing modern technology, sustainable practices, and farmer empowerment, White Revolution II can address the challenges posed by a growing population, changing consumer demands, and environmental concerns. A renewed focus on quality, safety, and innovation will not only boost the growth of the dairy industry but also contribute to the overall development of rural areas and the economy. White Revolution II is not just a necessity; it is an opportunity to transform the dairy sector and secure a brighter future for all stakeholders involved.

PRINT AND DIGITAL SUBSCRIPTION

SUBSCRIPTION TARIFF

S.No.	ONE YEAR 12 ISSUES	PRINT	DIGITAL
1.	Individual	800	400
2.	Student	500	250
3.	Organisation	1200	600
4.	Institute / Library	1200	600



FOR SUBSCRIPTION AND BUSINESS QUERIES

Please call in **+91 7290031468** or Email @ vinita.singh@agriculturetoday.in



visit our website

www.agriculturetoday.in



KISAN KI UNNATI SE HAI DESH KI PRAGATI.

SBI Agri Loan Products for your every agricultural need.

KISAN CREDIT CARD

- Interest rate at 7% p.a., up to ₹ 3 lakhs*
- 3% incentive for prompt paying farmers, up to ₹ 3 lakhs*
- Collateral-free loan for up to ₹ 1.6 lakhs



LOANS FOR SELF-HELP GROUPS

- Loan for livelihood
- Flexible repayment



ASSET-BACKED AGRIL LOAN

- Loan up to ₹ 2 Cr.
- Low interest rate



FARMER PRODUCER COMPANIES (FPCs)

- Loans available for all activities of FPCs
- Attractive interest rates
- Credit guarantee available
- Interest concession available



AGRI GOLD LOAN

- Digital sanction on YONO KRISHI
- Low interest rate



MUDRA LOAN

- No collateral up to ₹ 10 Lakhs
- Simple documentation



TRACTOR LOAN

- Landholding required: 2 acres
- Flexible repayment
- Low interest rate



ATMA NIRBHAR BHARAT SCHEMES:

- Loans available under Agri Infra Fund, PMFME scheme, AHIDF scheme
- To establish cold storage, warehouses, silos, food processing units, etc.
- Credit Guarantee available
- Interest subvention available

For more details, visit bank.sbi or contact Branch Manager