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Conference
VFF 2020
25-26 June

Vegetable Farmers Forum:

**Post Lockdown
With Particular Emphasis
on Plant Protection**



Dr G K Mahapatro
ICAR – IARI Regional Station
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Media Partner

SMART AGRI POST

Empowering agripreneurs...

Vegetable Farmers Forum: **Post Lockdown with Particular Emphasis on Plant Protection**

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NATIONAL WEB CONFERENCE VFF-2020

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**Vegetable Farmers Forum: Post Lockdown
With Particular Emphasis on Plant Protection**



हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

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National Web Conference

Vegetable Farmers Forum 2020

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Pages & Particulars



4 CONTENTS

5 Foreword

6 Preface

8 Vegetable Farmers Forum:
Post Lockdown with Particular Emphasis on Plant Protection



12. Sambhav – an NGO in Nayagarh is the New Narrative, *Yes it is Sambhav*

21 Eco-friendly Strategies for Pest Management in Vegetables

26 Impact of Pest Management on Pollinators
Plant Interaction in Vegetables



31 Food Safety:
A Major Concern for Fresh Vegetables

32 Vegetables Primary Processing & Marketing:
Case Study of Retail Industry

37 Impact of Covid-19 on Agriculture including Food, Veggie and Fruit MSMEs

39 Supply Chain Challenges of Fresh Fruits & Vegetables

42 Decentralized Cold Storage System:
A Boom for Small & Marginal Farmers

45 Tale of a Tribal Farmer: *Vegetable Farming*

49 Financing Agriculture: Types of Loans & Opportunities



51 Verifying Viral Virus Truth in **TOMATO**

58 Proposed Pesticide Ban and its Impact on Vegetables

62 Vegetable Gardening:
Approach for Nutrition and Wellbeing during Covid Pandemic

63 About My SNS Organic Farm:
My Subscription Group



66 Bt Brinjal:
An Indispensable tool for Brinjal Farmers in India

68 Diversity, Damage and Deliberation
Management of White grubs in Vegetable Crops

70 Nematode Problems in Vegetable Crops
In Indian Context

76 Plant Quarantine:
An Important Tool in Export of Vegetables

78 Model Nutri-gardens:
In Fighting Malnutrition, the Millennial Milestones in Indian Context

83 FEW CAPTURED MEMORABLE MOMENTS ONLINE

96 GLIMPSES OF 'DIIL'
Domain for Intellectual & Imaginative Littles



101 Web Conference Recommendations
Hindi & English

107 Termite Web-portal for Farmers



FOREWORD

Vegetable Farmers Forum (VFF) is a platform formed by a group of scientists, agri-preneurs, relevant subject matter specialists and farmers from various parts of country. This forum is unique as it was formed during the COVID lockdown period with a noble intention to serve the farming community, especially vegetable farmers. It was relevant to create such a platform for Vegetables considering its highly perishable nature. This forum could make substantial contributions to the vegetable farming community across the country. I congratulate them for the creation of such a forum to serve the farming community, even during this COVID pandemic situation.

Presently, research efforts by scientists and subject matter specialists across the country are focused on sustainable and profitable vegetable farming. The platform intends to address current and persistent crises in vegetable cultivation in the Indian context. This platform can also serve as a mediator enabling the transfer of technologies from research laboratories to the field. Moreover, the issues related to storage and marketing of vegetables can also be addressed by the forum and modified in a farmer profitable manner.

I appreciate VFF for organizing a National Web Conference (Natwebcon VFF-2020) on the theme "*Vegetable Farmers Forum: Post Lockdown with Particular Emphasis on Plant Protection*" during June 25-26, 2020. The Conference emphasizes on creating a platform for the benefit of different stakeholders associated with vegetable cultivation in India and intended to integrate different facets of vegetable farming such as production science, protection science, postharvest management, marketing and other socio-economic issues.

I am confident that the Conference will be successful in discussing, deliberating and recommending steps to adopt sustainable and profitable vegetable farming strategies. I wish Natwebcon VFF-2020 a grand success.

Date: 25th June 2020

Dr (Mrs) Chandish R Ballal
ICAR-NBAIR, Bengaluru



Preface

BHARAT is moving steadily in the path of progress, such as industrial, digital information communication and service sectors, but the agriculture growth in terms of its contribution to GDP is diminishing every year. Fifty four percent of the population in the country finds livelihood from agriculture and allied sectors. Even though our country has attained self-sufficiency in food, feed and fodder quantitatively, the qualitative aspects of attaining complete and affordable family nutrition in the country are to be reflected with equally good care on farmlands and farmers appropriately. The millions of malnourished women and children of country, remind us to set our goals and priorities once again. Currently, the pandemic corona has made the situation much worse than before, worldwide. The silver lining of the cloud is some innovative concepts are emerging during such crises, such as a small example, the formation of ***Vegetable Farmers Forum***, from **ICAR-IARI Regional Station, Pune**, as the Lead-centre. The Forum constitutes a group of scientists and other stakeholders, agri-preneurs and relevant subject matter specialists from various parts of country. It was formed on 20th April, 2020 as a service platform to assist farmers, extend advisories to vegetable farmers in particular, though encompassing the vegetable-based cropping systems. The platform has widened its reach to different parts of the country with maximum allowed members for a given WhatsApp group. In turn few members were selected, on voluntary-basis, to act as our Nodal Contact Persons. In turn, they formed their own WhatsApp groups, taking farmers and members, in their circle, suited to their region, local conditions such as languages, sub-theme areas (*eg.* Non-chemical/ Organic vegetable production) etc. They are in touch with the central core WhatsApp group. In this way, we already have reached more than 2500 members. Our target is to reach 10,000 clientele, through this forum.

The government removed vegetable commodities like tomato, onion and potato from the list of essential commodities; but these are essential items in our daily food basket and dishes. Being daily essential commodities, potato petrifies us, onion tears and tomato torments/tortures both farmers and consumers, when its cultivation or price in market fluctuates, affecting the common man mostly. The increased harvest of these agri-commodities brings in unreasonably low market price. The farmers are made to lose even the cost of production of these commodities season after season. The poor farm infrastructure and cold storage facilities reduce the holding capacity of farmers and trigger the lowering price for perishable vegetable commodities due to distress sale. In this context, the post-harvest management of such commodities with primary and secondary processing at or near farm gates is to be established. Micro, Small and Medium Enterprises (MSMEs) should be encouraged with appropriate incentives to involve with vegetable farming groups (VFGs) in every district to see that there is regular unhindered market for them. In fact if MSMEs can enter into contract vegetable production, there shall be symbiotic benefits that would alter the scale of operation. End-to-end vegetable production from 'seed to market' is to be aimed through MSME platforms.

The proposed National Web Conference (**Natwebcon VFF-2020**) is expected to encourage better public-perception and effective student-scientist interaction in various facets of vegetable cultivation. The TWO days online conference constitutes invited lectures by eminent speakers, key speakers, contributed oral/posters from scientists & students, from forward farmers even. Virtual visits through a **PadmaSree Awardee's** Natural Farm and NGO (**Sambhav - Nayagarh, Odisha**) is inclusive in our content, in the context of this connecting people to such worthy and spectacular contributions from non-agriculturists' initiatives and innovative minds. The conference will hopefully enrich knowledge in various aspects of vegetable cultivation, *viz.*, production science, protection science, post-harvest

management, marketing strategies, and the socio-economic aspects including associated MSME. With an aim to inculcate value-added-education orientation, the Conference also devotes a special session – Cultural-cum-motivational module by children, for the 'Young intellectual minds' organized by **DIIL** (*Domain of Intellectual & Imaginative Littles*) New Delhi.

We earnestly hope that this Web Conference will pave a way to the integration of research& developmental efforts of stakeholders in this field of vegetable farming and marketing.

Certainly, we will fail in our duty, if not acknowledging Director, IARI for all the support, inspiration and all round cooperation from the day one of its planning. The support in the form of all logistics, IARI Zoom platform, and wider participation even through the You Tube, all are acknowledged wholeheartedly. The Media Partner **Smart AgriPost**, is quite instrumental in making the conference reaching wider audience, timely e-publication supports, thanks to Editor & Owner Mr Pravash Pradhan, to be in our Core Committee as Media Coordinator. We tried our best to inculcate the culture of **Public-Private Partnership** in true sense and spirit. The supporting organizations – one SAU from Maharashtra (*VNMKV, Parbhani*), **WASME** (*World Association of Small & Medium Enterprises, New Delhi*), Ni-MSME (*National Institute of Micro, Small & Medium Enterprises, Hyderabad*), the **ESI** (*Entomological Society of India*); and **OLM** (*Odisha Livelihood Mission*) – all are thankfully acknowledged for their meaningful association in aiding our aim, to attain its zenith. The painstaking and untiring service and support from my Ph D students of Division of Entomology (Ms Rajna, Mr Sudhakar & Nikhil Raj), staff of Pune Station of Indian Agriculture Research Institute, and Dr RR Burman (*ICAR-IARI, New Delhi*) for Zoom platform coordination – all are worth-citing and praiseworthy. This page will be incomplete if we don't record the enthusiastic participation of the school children in the Cultural-cum-Motivation programme, arranged by **DIIL**. Our sincere thanks to all contributors – Lead/Key talks, Dignitaries (Dr Rashmi Aggarwal, Joint Director of Education & Dean-IARI, Shri Jagpal Singh, Secretary, *FARMER (Foundation for Agricultural Resources Management and Environmental Remediation)*, Ghaziabad (UP), contributory e-Oral and e-Posters, Virtual Visit content contributors, Judges of the Evaluation Team (Dr Chandish R Ballal, Dr Vinay K Kalia & Dr K Sreedevi), and at last but not the least, the farmers and little kids participating in the cultural event.

The continuous inspiration, support extended by our mentors for this 2-day Web conference – Dr AK Singh, Director, ICAR-IARI as **Patron**, Dr TP Rajendran as Adviser cum Critic, Former ADG (Plant Protection), Dr (Mrs) Chandish R Ballal, Former Director, ICAR - National Bureau of Agriculturally Important Insect Resources, Bengaluru – will be milestones of our memory lane.

Jai Kisan, Jai Vigyan, Jai Anusandhan.



Date: 25th June 2020

Dr G K Mahapatro

Organizing Secretary

Vegetable Farmers Forum: Post Lockdown with Particular Emphasis on Plant Protection



G K Mahapatro

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Living in such perilous time of current corona crisis, witnessing massive disruptions in all walks of life is very common. Thankfully, the governmental decision to keep agriculture in track and active during lockdown has a great relief. Needless to cite, practically agriculture sector is also a victim in this pandemic. Farmers are deprived of direct contacts and consultancies of agriculture officials/professionals in time of need added to several allied problems. To address this issue, ICAR-IARI Regional Station, Pune come up with this novel idea of founding a platform, a WhatsApp group – the *Vegetable Farmers Forum*. Born on 20th April during the corona lockdown, it is still an infant, hardly past two months, but worthy to cite, forum is already running in full capacity. Planned and projected to reach at least 10,000 farmers in the first tier itself, it has reached more than 2500 farmers. Happy to note, the National Web Conference, Vegetable Farmers Forum (VFF) – 2020 is the first contribution of the forum, the conference was conducted for full two days 25 – 26 June 2020.

Full filling the Digital India mantra, more than 800 participants were there online, directly with our zoom platform connection, and also on You Tube on first day in full. There were 17 lead talks, technical session with many contributory e-Oral and e-Posters, Virtual Visits to two organic/natural farmers (one PadmaSree Awardee, 2019), cultural-cum-motivational children programme organized by DIIL (Domain for Intellectual & Imaginative Littles), plenary and award ceremony session culminating with our National Anthem, in decorum.



(1956 – 2014, Shivaji Nagar, Pune)



(2014 – till-date, Aundh, Pune)

The LEAD centre for the National Web Conference VFF 2020

Pune – Pioneer institute of India on plant virus diseases established in 1938 (as Plant Virus Research Laboratory) by Imperial Council of Agricultural Research, British India

Needless to cite, British government has ideally identified and established IARI at Pusa (Samastipur, Bihar) as the seat of agricultural research in 1905; and at Pune as seat of research on plants & animals; as being the hot-spot for virus diseases, in 1938. The sanction of a scheme for research on virus diseases of plants in 1938 by the erstwhile Imperial Council of Agricultural Research, New Delhi was the harbinger for the establishment of **Virus Research Laboratory** at Pune (Campus: Shivaji Nagar, under Bombay Province). The objective of the scheme was coordinating all research work on virus diseases of plants of this region and country. Considering its national importance, the station was transferred to Indian Agricultural Research Institute (IARI), New Delhi on 1 April, 1956; and renamed as IARI Regional Station, Pune. Office and laboratories of the station were shifted to its old 18 acre experimental farm at Aundh, Pune in 2014. The station is the only one of its kind engaged exclusively in research and extension on virus and virus like diseases of fruits and vegetables. The station has characterized many viral diseases and developed their management practices, during last six to seven decades.

ICAR-IARI Regional Station, Pune took the lead, earnestly to contribute for the cause of farming community, while working from home online. A **Vegetable Farmers Forum** was planned to provide a platform for the farmers to discuss their pressing issues in vegetable farming in generals and on plant protection sector in particular. The members were drawn from various parts of the country – Assam, Andhra Pradesh, Bihar, Delhi-NCR, Gujarat, J&K, Karnataka, Kerala, Jharkhand, Odisha, MP, Maharashtra, Rajasthan, Tamil Nadu, Telanagana, UP, WB, etc. Agro-experts were invited and they joined voluntarily from various fields – Agronomy, Soil Chemistry, Horticulture, Entomology, Nematology, Plant Pathology, Agricultural Statistics, Vegetable Science (Olericulture), Agricultural Economics, Extension, Agri-business Management, Protected Cultivation, Agro-Forestry and etc. Couple of current and former Vice Chancellors, Directors, Deans/Principals, Project Coordinators, Head of Departments, District Agricultural Officers, NGO Consultants/Activists, Agriculture Journalists, and Bank Officials (NABARD, SBI) also joined the galaxy of experts. Till-date we covered and discussed on various hot issues raised by farmers and members. In gist these were:

The forum was instrumental in information sharing on governmental circulars/notifications relevant to agriculture such as *Atmanirbhara Bharat Abhiyan*, Arogya Setu, Kisan Suvidha, Kisan Rath App, www.marketmirchi.com etc. A collage was prepared to applause and support the farmers, the real heroes of corona pandemic times, like dedicated health departmental staff, police force and other essential service staff. The Collage was compiled by our station staff, and circulated widely, inclusive within this Forum as well.



Corona has offered a unique opportunity, the current crisis of Indian economy that is the declining contribution of agriculture in GDP (now only 15%) has prompted us to review the country's situation and it is realized that marketing and making profit is the key to successful agriculture. COVID-19 is playing a catalytic role by enabling India's agro- innovative minds to develop solutions towards easing the farming community. Perhaps it is time for India to emerge as a leader via 'Agri-preneurship'.

Advisories in Vegetable Crop Production and Protection technologies

- Plant protection queries in vegetables and papaya, were addressed with suitable sharing of booklets/pamphlets, bulletins etc online.
- Queries on virus problems in vegetable farming were addressed, like insect pests, insect-vectors, termite problems (website www.termitexpert.in) nematode problems, plant diseases – fungal, bacterial and viral (ring spot virus tolerant lines, virus diseases of tomato, chilli, papaya etc).
- Deliberated on Safe use of pesticides, label claims, recommended pesticides, sharing of registered pesticides, pesticide formulations, banned pesticides etc.
- Organic options were also discussed.
- Relevant traditional knowledge in pest control is discussed.
- Safe use of pesticides, label claims, recommended pesticides, sharing of registered pesticides, pesticide formulations, banned pesticides etc.
- Veggie decontamination/sanitization in covid period – this was discussed with appropriate advises and suggestions.
- *Swatcha Kheti* – Stressed on Good Agricultural Practices (GAPs) as a domain of *Swatchha Bharat Abhiyan*.
- Various concepts were deliberated in length in the forum. viz.,
 - ✓ IPM – Integrated Pest Management, IDM - Integrated Disease Management, and INM - Integrated Nutrient Management – All inclusive under the aegis of Integrated Crop Management (ICM)
 - ✓ Water management – *per drop more crop*
 - ✓ GAP – Good Agricultural Practices, Sustainable Development
 - ✓ Integrating ITK and frontier science, Honey bee – *Madhukranti*.
 - ✓ Market oriented farming, post harvest management etc.
 - ✓ Protected cultivation practices etc.

Deliberations were also directed on entrepreneurships in farming, need of effective marketing strategies, post harvest management, organic farming, food supply chain issues, in view of the current corona crisis etc.

Facilitating the First Interface-in-Internet Meeting for Nutri-gardens

Ajim Premji Philanthropic Initiative (APPI) had signed a MoU with Government of Odisha to Improve Nutritional status of Women and Children across Odisha through mainstreaming Dietary diversity interventions by building Capacity and establishing a Nutrition Vertical within Odisha Livelihood Mission (OLM). Project aims at training of 7.5 lakhs women on Nutrition practices, establishing Nutri-gardens and Back yard poultry, across 750 Gram Panchayats of 107 Blocks in all 30 districts of Odisha. OLM has received **Outlook Poshan Award** (2019) for implementing this nutrition sensitive project. At present about 93,000 Backyard nutrition gardens established across Odisha. APPI has identified and supported three resource NGOs (PRADAN, LIVING FARM and Harsha Trust) to work with OLM as Knowledge partners for this project. OLM has 3.5 Lakh Self Help groups and 13,000 community cadres to implement various interventions, so SHG platform and Community cadres of OLM have been contributing to implement this project.

IARI Regional Station, Pune facilitated the Online Zoom Meeting on 2nd May 2020 (10.30am to 12.45pm). IARI Regional Station also proposed to take such model nutri-gardens with required modifications in Pune, Maharashtra, integrating papaya lines (PS series, tolerant to ring spot virus), moringa/ drumstick crop, and

honeybees (stingless bees) including evaporative cooler room storage facility for veggies and fruits as model.

The response till-date is very good in this Forum. The lock-down period is quite favourable for experts to divert their time. The upper limit of membership in WhatsApp is 256 only, and it is planned that, post-covid India, we may switch over to an appropriate digital platform for better performance and wider coverage precisely. To expand the network, make it reaching wider customers/clientele base, we proposed and has invited 100 nodal contact point persons (NCP) from various regions/sectors/themes. They will in turn connect to 100 farmers/beneficiaries. This way we reach 10,000 farmers in first level. Second level if each beneficiary point connects to at least 10 farmers, we arrive at 1 lakh clientele.

NUTRI-GARDENS IN ODISHA – ACTIVITIES



Harvest of green vegetables by women



Home made feed to poultry



Compost making training and demonstration



Meeting at Self help groups



Happy women on vegetable production



Model of Nutrition garden demonstration

Sambhav – an NGO in Nayagarh is the New Narrative Yes it is Sambhav (=Possible)



PadmaSree Sabarmatee – striving for sustainability

MISSION POSSIBLE (Sambhav) started somewhere in 1989. Led by an intellectual, a professor, few like-minded people including his daughter, bought an acre of waste land at Rohibanka in Nayagarh district of Orissa. They wanted to convert this patch of land to forest following natural practices. Organic farming was not that popular and widespread that time in country. Nearly three decades of hard dedicated work took their one-acre expanded in to ninety acres and with lush green vegetation, a beautiful biodiversity patch. They adopted soil and water conservation techniques via mulching and water harvesting in ponds. In 1989, they registered **Sambhav** – a NGO, to work on organic farming and ecological conservation. A two and half acre patch is used for seed preservation, to grow and preserve nearly 800 traditional varieties. Sabarmatee is promoting food security through crop diversification. Her efforts have built up valuable repository of variety of seeds that withstand the effects of climate change. Traditional varieties are certainly climate-resilient, suitable for the local conditions – she believes strongly. She suggests sowing multiple varieties, same time in an area avoiding adopting a single variety. Hybrid and high yielding varieties has spoiled our serene system, she opines. She is true, the changed pest scenario, in many crops including veggies, across the country supports her view in some cases, if not for all, at least. Sabarmatee was awarded the **Nari Shakti Award** by the President of India in 2018 her work. Later, father-daughter duo earned the most coveted **PadmaSree Award**, the fourth Highest Civilian Award of India.

In the latest locust invasion case, her suggestions for the farming fraternity and ecosystem, due to large-scale toxic chemical control interventions exhibits her great concern in this direction.

Contact:

1. **Sambhav** PO, Rohibanka
Nayagarh-752090, Odisha.
2. **Back to Village**
AcruX Neon, Hanspal Road, NH-16, Block C, Bhubaneswar-752101, Odisha.

Editorial compilation by Dr GK Mahapatro and Nikhil Raj

Sambhav: The Transformation

It was 1988, location Rohibanka – a rural village in Odgaon block of Nayagarh district in Orissa, a completely barren land, no grass for grazing by cattle, full of gullies, degraded top-soil – seemed impossible to rejuvenate. The story started thus. A small group, thought to reclaim it, led by Professor Radhamohan and his dedicated daughter. People laughed at, some were suspicious. While addressing a gathering on this issue, someone elderly local person snubbed, “*You city-bred people, says good things to ears, but impossible (Asambhav, in Odiya) to grow anything here this patch of land.*” Taking the challenge, the journey of transformation started, organization *Sambhav* thus born on 8th March 1989. Like-minded people joined this journey. And rest is history; today it is a feast for eyes to see the place with plants everywhere, lush green vegetation, rich biodiversity, inhabiting animals, avian species, insects, reptiles, amphibians and so many other wild lives. The team had dedicated entirely for nature conservation, the prime objectivity of this mission.

The barren wasteland was converted into highly diverse stable vegetation within a span of three decades. Results are quite evident from the scenario, and highly inspiring because out of total 329 million hectares in India, 90 million hectares are classified as wasteland that is non-productive land yet it is used by 40% of our population for its livelihood. So any path that leads to reclaiming such wasteland into fertile biodiversity patch, not only improve livelihood of on community scale but also aid to ecological stability and sustainability that help us fight against poverty and climate change at the same time.



SAMBHAV made it sambhav (possible) – journey through three decades

Moreover the increase in biodiversity not only helpful for humans alone, the other animals in the ecosystem are also attracted to the newly developed biodiversity rich area, because of more accessibility and availability of food, shelter and mates and it will become more and more self-sustainable habitat in coming years as more species will flow into this area in search of better habitat. In this era of drastic climate change mainly due to deforestation and natural resource destruction it will make good sense to use the

wasteland and convert it into more bio diverse vegetation. It may help us to counter climate change as well as provide farmers more sustainable livelihood. Thus it is a very good initiative and focuses on underutilized barren lands which can be pivotal in future for finding new cultivable land area.



The biodiversity harbours diverse animals in its territory

This newly formed cultivable land can be used for cultivation of array of native and local crops and crop varieties, which are more climate-resilient and tolerant to the harsh environment. Using this crops will have more successful cropping seasons and better yields.



The Clove bean (uncommon in Odisha) and few root crops - diversity

Food security through crop diversification

It is well known fact that insect pests and diseases are directly proportional to chemical usage. Higher the Nitrogen content higher the attack, higher nutrient availability reduces immunity and resistance, and monocropping help in faster build-up of pests and diseases. Moreover chemical usage kills natural biocontrol system by damaging biocontrol agents and leave open field for pests to attack. As organic crops have to struggle for nutrients and fight with pests on its own, it has more resistance and immunity. Therefore organic system is less prone to pest attack.

Sabaramatee believes in struggle, strive for nature conservation. She opines, seeds from various sources can be procured, sown in field, let see the problems propped up, solution lies within nature, understand the nature, your crop, your surroundings. This is the natural way of learning, doing yourself, learning yourself,

from nature. Nature is the Teacher. Adequate deeper understanding of these intricacies is imperative for solving our problems, mitigating the challenges of climate change, food security, lead a meaningful life in nature, and let others also live in nature.

We certainly need a visit, to this wonderland in Odisha, to witness the worthy transformation, to realize the nature in better terms. Despite her suggestion, to avoid their names in our narration, we could not comply strictly, though tried earnestly. Our editorial is thus, incompetent and incomplete in letters but in full spirit; at best we attempted here, to take YOU all to a **Virtual Visit**.

Vegetables – in Variety at Nayagarh



Mixed Vegetables - Amaranths, Ram Dana – with pink seeds



Bottle gourd



Flowers of pink carrot



Snake gourd



Cluster bean



Pink Okra



Winged bean



Crop mulching



Winter bean diversity



Ridge gourd



Diversity in Amaranths



Tomato+Dill (Sua)



Clove bean



Ridge gourd



Watermelons – all organically grown in this wonderland



Tomato – in diversity



Potato – Phulbani local



Wild Diversity in Wonderland of Nayagarh



Only diversity can save
At the service of Mother Nature,
Sambhav

Non-Chemical Approach to Locust (*Pangapa*) Management

Sambhav

Rohibanka, Nayagarh-752090, Odisha



Locust invasion apprehension in Odisha by mass-media

FAO has predicted that desert locusts (popularly known as *Pangapa* in Odisha), which are not generally seen in our areas, are likely to come to Eastern part of India in June - July. They may or may not come depending upon favourable weather condition. But we have to stay prepared. Governments at center and states have been working out to warn in advance and minimize the damage by issuing advisories and using their control strategies.

REMEMBER, CHEMICAL SPRAYING, ESPECIALLY, AERIAL SPRAYING OF POISONOUS CHEMICALS LIKE CHLOROPYRIPHOS, MALATHION etc., ACTUALLY HARM NOT ONLY TO LOCUSTS, ALSO TO OTHER ORGANISMS, SOIL, WATER, AIR – EVERYTHING AND EVERYBODY IS POISONED.

Situation gets more complicated after that. So we have to give a thought to it. They have been existing for thousands of years. Trees, plants and also we have survived. **So no fear, but stay prepared.** It needs our **collective action** to manage locusts.

Desert locusts are different than the grasshoppers normally we see. Adults are brownish in colour, have longer wings, come in millions at a time, equal to size of a city, eat in tons, fly for miles and miles. They may not come to all areas and do not also stay for long time in all areas.

It is challenging to control them if they reach here while it rains. However, based on some principles like Principle of Disliking, we are suggesting some methods for locust management.

We can try to do our best at local level.

- **Priority** is to save short duration crops. Trees can regenerate after they leave.
- Put many sticks for **bird perches** in the crop fields where our insectivorous birds will come, sit and catch locusts. They cannot eat them all, but can eat a lot.
- Chickens and ducks love protein - rich locusts. One may use net to catch them and **feed chicks, ducks and fishes.** Some other animals also like to eat them. But if they are spread with insecticides in other places, then **it is dangerous to feed** them to our chicks and ducks and fishes.

- **Create high decibel sound** using any metal container like bucket, drum, tin etc. and our *Kirtan* instruments like *ghanta*, *mridang*, *gini* etc.
- Take thorny branches and beat the swarms.
- Keep dry twigs, branches, dung cake etc. ready in different spots in the field and when you know about their arrival, put various leaves having strong smell (like neem, karanj, pokasungha, bantulsi=wild tulsi), turmeric powder on that and fire to **create smoke** in the crop field.
Dhwani and Dhuana – desirable desi dabba (sound and smoke)
- Soak old dhotis or sarees or gunny bags in kerosene and neem / karanj oil mix and hang them horizontally above the crops or vertically at places inside the crop field which should not touch the plants. The **smell** is likely to **repel** them.
- **Use Antifeedants:**
 - ✓ Dig around 4 ft deep trench in the farm and collect 30-40 kgs of soil, mix well with 200 liters of water. Allow it to settle down for around 20 minutes. Strain and spray over the crop. Locusts don't eat soil. After they are gone, spray the crop with water. (Padmashri C Venkat Reddy of Telengana)
Addition of neem-derivatives to mud-spray will make it effective (editorial suggestion).
 - ✓ Mix 5% Neem Seed Kernel Extract in 200 L of water and spray over crops (IARI, OUAT) or other neem based biopesticides. (total 200 L per acre)
 - ✓ This is the season for collecting Neem seeds. So please do not miss the opportunity. You can at least crush or grind the seeds, pour boiled water on them and put that in a container with mouth closed (1 kg Neem seed: 2 L of water). And after 24 hours, strain it, mix with 15 -20 liters of water and spray over crops. (total 200 L per acre)
 - ✓ Take a bottle or a jar. Put 500 ml of Neem or Karanj oil (kerosene could be used for non-edible crops) in it. Grind 250g of garlic and 100g of chili without adding water and put that in the oil. Keep 1/3rd space empty in the bottle. Then keep it covered. It is ready to use in 24 hours. Mix 2-3 pinches of soap in 10 L of water and add 50-100 ml. (depending upon the situation) of this oil, steer well and spray over the crops. It helps repelling other crop eating insects also. Repeat after 5-7 days. (total 200 L per acre)
 - ✓ Take 1 kg of bitter tasting, strong smelling leaves and the leaves of plants which goats do not eat and crush or cut and keep in a container. Pour 5 liters of boiled water in it. Cover the mouth immediately. Strain the solution after 24 hours. Add 1-2 liter of cow/goat urine and 100 ml of neem or karanj oil. Mix well with 40 liters of water and spray well over the crops. (total 200 L per acre).
- Remember, they are inactive from evening to morning. So some people collect the locusts after beating the crops with thorny branches and put them in a trench and cover with soil to make good compost.
- As they are coming in June- July, people are likely to have their main crops or crop nurseries (rice, millets, maize, vegetables, oilseeds etc.) standing in the field. So **keep extra seeds ready**. In case you cannot control them and your crop is lost, you can immediately put a nursery for short duration and plant young seedlings.

From all these suggestions, we can do whatever we can, but preferably collectively on community basis. Do not forget to observe what crop they are not eating and please document your observations (like when they came, what you did, whether that worked or not etc.) for future learning. This is not end of the list. You can also be innovative. You can also do something new which may work better. They come in millions. So we also have to act collectively, not alone. And we should try our best not to poison ourselves and everything else by following non-chemical management methods.

STAY INFORMED, STAY PREPARED, ACT COLLECTIVELY.

Eco-friendly Strategies for Pest Management in Vegetables

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Excess use of chemical pesticides in agriculture and horticulture has resulted in serious environmental problems, has affected the soil health and eroded the sustainability. World-wide, there are 500 species of resistant insects, mites and ticks compared with only 25 in 1955. Coupled with this has been the well-publicized environmental effect, such as toxic residues on produce, destruction of beneficial insects and other non-target organisms, and human poisoning. The World Health Organization (WHO) estimates that world-wide over a million people are poisoned with pesticides each year and up to 2 percent of cases may prove fatal. There is global realization that maintaining the productivity in a sustainable manner with sound resource management would be a key issue in the coming years. Several non-chemical methods of pest management have been tested and a few have been found quite useful like growing varieties with pest resistance, adopting organic manuring, cultural and mechanical methods of pest management, behavioral control using light, pheromone and yellow sticky traps and last but not the least adopting biological control methods. Biological control agents like parasitoids and predators and bio-pesticides offer an alternative method of control, which in spite of not having a quick knockdown effect, does not seem to provide the rapid development of resistance in the field, leaves little or no toxic residues and is generally harmless to beneficial insects and other non-target organisms.

Several parasitoids, predators and pathogens can be effectively used for the management of pests of various agricultural and horticultural crops. Inundative releases of laboratory-reared entomophagous insects either alone or as a component of IPM have been found to be useful in the management of several pests of vegetables. Microbial organisms can be used for the management of pests and plant pathogens. Several groups of microbials like bacteria encompassing diverse strains of *Bacillus thuringiensis*, fungi like *Metarhizium* spp., *Beauveria* spp., *Lecanicillium lecanii* and *Paecilomyces* spp., baculoviruses particularly nuclear polyhedrosis and granulosis viruses and entomopathogenic nematodes have been found to control several pests effectively. By adopting biocontrol strategies in several crops, use of chemical pesticides can be reduced and in some cases totally avoided. In this presentation, I intend to focus on some of the promising examples of biological control and biocontrol compatible approaches for managing pests of vegetable crops.

A successful parasitoid should have a high reproductive rate, good searching ability, host specificity, be adaptable to different environmental conditions, and be synchronized with its host (pest). No parasitoid has all these attributes, but those with several of the above characteristics will be more important for use in suppressing pest populations. In nature, several parasitoids been observed to be potential bio-agents of serious crop pests. The emphasis should be on documenting the important natural enemies which play a

major role in pest suppression and conserve them. Here are a few examples. On cabbage, cauliflower and other cole crops, diamondback moth *Plutella xylostella* is a major pest and *Cotesia plutellae* is an important parasitoid in Gujarat, Karnataka and Tamilnadu, while *Diadegma semiclausum* in the Nilgiris; *Campoletis chloridae* and *Eriborus argenteopilosus* are important early larval parasitoids of *Helicoverpa armigera* in the pigeonpea and chickpea ecosystems. Anthocorid predators have been recorded as potential bio-agents of different species of thrips in various ecosystems. *Orius* spp. are the most common anthocorids which have been recorded from different crop ecosystems. These studies indicate the need to conserve such promising bioagents.

Conservation biocontrol is an important strategy, which can be adopted with minimum effort. Besides abstaining from the use of chemical insecticides, thus conserving the beneficial fauna, there are several ecological engineering and cropping strategies which compliment conservation biological control strategies. Diversified cropping like mixed cropping, inter cropping or trap cropping are known to reduce the pest numbers and encourage natural enemies. Planting of cowpea as a bund crop attracts the predator *Menochilus sexmaculata*, maize as intercrop is known to encourage *Chrysoperla carnea*, growing cowpea as a trap crop increases the parasitism of *Helicoverpa armigera* larvae and predation of eggs by coccinellids, growing *Tagetes* spp. as border crop attracts heavy egg laying by *H. armigera* which inturn attracts parasitization by *Trichogramma* spp.

Augmentation biocontrol strategies involve the production and utilization of macrobials and microbials. *Trichogramma* spp. are widely used in augmentation biological control. Tricho cards are used for management of lepidopteran pests infesting vegetable crops like tomato, bhendi and cole crops. Though the utilization of "Tricho-cards" is popular amongst farmers for the management of several of the lepidopteran pests in the egg stage, commercial entrepreneurs have not come forward to produce Tricho-cards due to its short shelf life, leading to problems in managing demand-supply chains. ICAR-NBAIR has addressed this issue and has come out with a technology for long term storage of Tricho-cards through induction of diapause of *Trichogramma* in pre-pupal stage. Coccinellid predator *Cryptolaemus montrouzieri* and the chrysopid predator *Chrysoperla zastrowi sillemi* are released for management of mealybugs, aphids and thrips. Releases of anthocorid and mite predators for targeting thrips and mites have been initiated and evaluated in India, while they are widely used in other countries, especially in polyhouses. Studies have also indicated that augmentation of combinations of biocontrol agents can enhance the overall suppression of multiple crop pests as in the case of *Trichogramma chilonis* Ishii with *Cryptolaemus montrouzieri* Mulsant for the management of brinjal shoot and fruit borer and brinjal mealybug.

To tackle exotic pests, generally we turn to classical biological control. Unfortunately, classical biological control does not always work, the reasons for failure may include the release of too few individuals, poor adaptation of the natural enemy to environmental conditions at the release location, and lack of synchrony between the life cycle of the natural enemy and the pest. India is rated as one of the top 10 countries in the world in the area of biological control. Where success has been achieved in classical biological control, the underlying ecological mechanisms are not always clear.

The spiraling whitefly, *Aleurodicus dispersus*, a native of the Caribbean region and Central America, probably came to India from Sri Lanka or the Maldives. It was first reported in 1993 from Kerala and later from other parts of peninsular India and the Lakshadweep islands. The pest is highly polyphagous and has been recorded on 253 host plants in India. Two aphelinid parasitoids, *Encarsia guadeloupae* and *E. sp. nr. meritoria*, have been fortuitously introduced together with the host into India. With the accidental introduction of both species of *Encarsia* into India, there has been a perceptible reduction in the population of *A. dispersus*.

The invasive papaya mealybug *Paracoccus marginatus*, an alien mealybug native to Mexico, was first reported on papaya in Coimbatore, and soon it spread to neighboring districts infesting cassava (tapioca), mulberry, teak and more than 100 other plant species including vegetables. ICAR-NBAIR with help from the United States Department of Agriculture (USDA) imported three natural enemies of the papaya mealybug, namely, *Acerophagus papayae*, *Anagyrus loecki* and *Pseudleptomastix mexicana*, from the laboratory of Animal and Plant Health Inspection Services (APHIS) at Puerto Rico. A large-scale production technology was developed and one of the parasitoids *A. papayae* was distributed to all the states which reported infestation by the papaya mealybug. Within a period of six months, the papaya mealybug was controlled successfully. The total economic benefit over five years was estimated to be \$ 1,340 million. It is estimated that an annual saving of Rs 1,623 crores has accrued to the farmers in Tamil Nadu, Karnataka and Maharashtra.

There are instances where attempts to tackle invasive pests using indigenous natural enemies have also been successful. One example is that of the recent invasive fall army worm (FAW) (*Spodoptera frugiperda*) (JE Smith), which after spreading across sub-Saharan Africa has entered into South Asia, creating total distress to the smallholder farmers. Though FAW is a very serious pest on maize, it is reported to attack vegetable crops too. In India, occurrence of FAW was first reported by ICAR-NBAIR as a PEST ALERT on its website in July 2018. The damage was first noticed in Karnataka, where the incidence ranged from 9.0 to 62.5 percent and by 2019 August, it has been reported in almost all the states except J&K and Himachal Pradesh. A search for indigenous natural enemies resulted in a report of an indigenous natural enemy complex comprising of egg parasitoids viz., *Telenomus* sp. and *Trichogramma* sp.; egg larval parasitoid *Chelonus* spp., gregarious larval parasitoid *Glyptapanteles creatonoti*, solitary larval parasitoid *Campoletis chlorideae*; a solitary indeterminate ichneumonid larval-pupal parasitoid and a larval-pupal (?) pteromalid parasitoid *Trichomalopsis* sp. Several predators were found associated with the pest viz. earwig *Forficula* sp., predatory bugs *Andrallus spinidens* and *Eocanthecona furcellata*. Epizootics of entomopathogenic fungus *Metarhizium (Nomuraea) rileyi* (Farl.) Samson was also recorded in Chikballalpur, Shivamogga and Bangalore causing considerable mortality of the pest in larval stage. Through very intensive search in several infested fields, virus infected FAW larvae were also collected from the field. ICAR-NBAIR evaluated all the promising bioagents from its natural enemy repository including egg parasitoids, entomofungal pathogens, *Bt*, NPV and entomopathogenic nematodes. The initial laboratory testing and small plot trials led to the identification of the following bioagents which could form integral part of an IPM module viz., Egg parasitoids *Trichogramma chilonis* / *Trichogramma pretiosum* / *Telenomus remus*, microbials *Metarhizium anisopliae* (NBAIR Ma-35), *Beauveria bassiana* (Bb-45), *Bacillus thuringiensis* (NBAIR Bt-25), EPN (NBAIR Hi-38 & NBAIR Hi-101) and *Spfr* NPV. These bioagents developed by NBAIR were widely tested and validated in the different states under FAW attack through farmer field trials and also through the AICRP Biocontrol centres and KVKs. The results of the biological control trials are highly promising, thus encouraging the researchers and farmers (PC-Personal communication: Drs B Ramanujam, R Rangeswaran, M Nagesh, G Sivakumar, J Patil, Richa Varshney, Omprakash Navik, NBAIR).

Microbial pesticides viz. fungal pathogens, *Bt*, viruses and entomopathogenic nematodes are also effectively used for pest management. *Bacillus thuringiensis* (@ 2kg/ha) is effective for the management of *Earias* sp. on okra, brinjal fruit borer and diamondback moth on cabbage in Punjab. At Himachal Pradesh, *Bt* subsp. *kurstaki* at 1kg/ha with EcoNeem Plus® at 2ml/l were effective in suppressing early instar larvae of *Pieris brassicae* on cole crops. At Uttaranchal, seed treatment with *Trichoderma harzianum* isolates PBAT-39 and PBAT-38 (10g/kg seeds) was effective in suppressing anthracnose in chilli. Seed treatment alone or combination with foliar application of different biocontrol agents significantly reduced rust severity and increased grain yield of vegetable pea. The module comprising of two sprays of *Bt* and six releases of egg parasitoid *Trichogramma brassicae* could significantly reduce DBM population on cabbage, with an increase in marketable yield in Karnataka. Use of bio-agents – *Bt* @ 0.5 ml and 1ml/l or *Metarhizium anisopliae* @ (1×10^9 spores/ml) at weekly intervals - resulted in reduction in larval population and damage by *Diaphania indica* on gherkins in Karnataka.

Soil pests including scarabaeid grubs, curculionid adults and grubs and larvae of cut worms are serious biotic limiting factors for quality production of vegetables including potato, beetsugar, ginger, turmeric, cole crops, etc. NBAIR has successfully established effective control of whitegrubs attacking sugarcane, arecanut, cardamom, etc. utilising EPNs like *Heterhabditis indica*, *Steinernema abbasi* and *S. carpocapsae* @ 3.0×10^9 infective juveniles per ha at 6 monthly intervals for 3 doses. A technology has been standardized for mass producing EPNs. Several commercial companies have purchased this technology from NBAIR. Thus, the availability of EPN as viable and effective formulations as biocontrol agents against soil-borne insect pests in horti-agri systems has become a reality. The current production by these companies is about 10-12 tonnes of EPNs per month (PC: Drs M Nagesh & J Patil, NBAIR).

Insect pheromones are essential components of monitoring and management tools targeting pests of agricultural crops and are considered as one of the eco-friendly strategies. Besides monitoring, pheromone technologies are used mating disruption, mass trapping, attract-and-kill, and push-pull. NBAIR has developed an innovative technology of a controlled release dispenser for delivery of tomato pinworm, *Tuta absoluta* pheromone. The nanoporous matrix trapped over 400 moths per. Controlled release matrix for delivery of FAW, *Spodoptera frugiperda* pheromone was also developed, which trapped over 20 ± 3.13 adult males per trap during three weeks period as compared rubber septa that trapped less than 13 ± 2.82 moths per trap during same period of observation. Controlled released dispenser is effective for over 45

days. Both the technologies were commercialized so that they become available to farmers (PC: Dr K. Subaharan, NBAIR).

Plant parasitic nematodes have been one of the major limiting factors in several crops, because of their perennial mono-cropping, the fruit, ornamental, medicinal and aromatic crops favour nematode multiplication and population buildup over a period of time and cause yellowing, wilting, slow decline and ultimately plant mortality at prime stages of crop productivity. At NBAIR, use of a combination of nematode trapping fungus, *Arthrobotrys oligospora* and antagonistic fungus, *Pochonia chlamydosporia* at 4×10^8 spores/m² at 6 monthly interval in colored capsicum & cherry tomato effectively controlled root-knot nematode infection to less than 15-20% infected roots. NBAIR has developed solid-state and diphasic fermentation and post-production technologies for contamination-free antagonistic fungi for the management of root-knot and cyst nematodes and Indian patent rights have been granted to - *A simple and novel design for small-scale solid state mass production unit for antagonistic fungi* (Indian Patent No. 275009) (PC: Dr M. Nagesh, NBAIR).

The management of plant diseases using biocontrol agents has been emphasized during the last two decades. The fungal and bacterial antagonists have been identified and advocated for the management of soil borne diseases. Among the fungal antagonists, formulations of *Trichoderma* species play important role. For the seed borne diseases of horticultural crops especially damping off, caused by *Pythium*, *Phytophthora*, *Rhizoctonia* etc. the use of seed treatment with *Trichoderma* formulations as well as use of *Trichoderma* cocopeat in nursery have been proved to be very useful. For the soil borne diseases in the main field also application of *Trichoderma* enriched farm yard manure (1:100 w/w) for one acre can reduce the disease spread.

Chilli anthracnose caused by *Colletotrichum capsici* is an economically important disease that causes both qualitative as well as quantitative losses in chilli production in India. A promising antagonistic strain of *Trichoderma harzianum* (NBAll Th-3) applied through seedling dip and foliar applications of talc based formulation at the rate of 10g/kg seeds and 10g/litre of spray fluid has reduced the disease by 42% in Byadgi kaddi and up to 37% in Byadgi dabbi in Karnataka and by 56% in Tejaswini variety in AP. This ecofriendly technology has thus facilitated the availability of healthy and robust seedlings without usage of fungicides. The bio-control based technologies of NBAIR have been demonstrated in farmers' fields in different states, thus creating awareness amongst farmers on this environment-friendly method of pest management (PC: Dr B Ramanujam, NBAIR).

Transcending the coordination and cooperation on a given pest is an important shared need for advances in regulatory policy, general methodologies for release and evaluation of natural enemies, and the need to develop sound ecological theory concerning pest population dynamics, predator-prey interactions, and the genetics of colonization in biological control. Future biocontrol attempts must consider climate variables in evaluating long term effectiveness. Biological control scientists are expected to provide management professionals with sustainable and effective tools with which to manage the relentless pressure of invasive species and indigenous pest outbreaks on natural and agricultural ecosystems. More in-depth studies need to be conducted to understand the compatibility of biocontrol with other pest and disease management approaches. We hope, the future of "insecticide-less" pest management strategy will be driven by a bouquet of parasitoids, predators and microbes complimented with other compatible tactics.



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Graduated, and post-graduated from Calicut University, and Ph D degree holder from Mysore University. Her first posting as Scientist was at ICAR-IIHR, Bangalore in 1985, later she moved on to erstwhile Project Directorate of Biological Control, which is now ICAR-National Bureau of Agricultural Insect Resources. She was the Head of the Division of Insect Ecology from 2013 to 2016 and Director of ICAR-NBAIR & Project Coordinator of AICRP on Biological Control from 2016 to 2020. She handled around 40 research projects and has more than 300 research publications (including research papers in peer reviewed journals, book chapters, edited books, Technical bulletins and Symposium papers) to her credit. She has received international travel grants from DST, IOBC, CSIR, CABI, ICAR, FAO and Beijing Academy of Sciences to present her research papers in international conferences in India, Greece, China, Srilanka, Nepal, Bangkok and USA. She is an elected fellow of several Professional Societies and is the recipient of several awards and recognitions including Prof. TN Ananthakrishnan Award 2006, Dr Sithanantam Award 2010-11, NBAIR scientific excellence Award 2015, Dr SP Singh Biocontrol Lifetime Achievement Award 2016, the prestigious ICAR Panjabrao Deshmukh Outstanding Woman Agricultural Scientist Award 2015 and most recently Dr S Pradhan Memorial Award 2018 from IARI, New Delhi, Dr (Ms) Prem Dureja Endowment Award from National Academy of Agricultural Sciences for the Biennium 2017-18 and Dr BV David Lifetime Achievement Award 2019. Throughout her career, by way of training of stake-holders, publications related to biodiversity & biocontrol, guidance provided to students, farmer interactions and supply of quality biological control agents, she has made concerted efforts to create awareness on the importance of a healthy environment and to popularize the concept of biological control amongst all stake-holders.

Impact of Pest Management on Pollinators – Plant Interaction in Vegetables

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Pollinator *Bombus haemorrhoidalis* foraging on tomato, and bottle gourd

Vegetables are an indispensable part of human life as they are keys to economic development, nutritional security, employment generation and overall economic growth of nation. They help us to maintain valuable alkaline reserves in the body and provide necessary ingredients for repair, buildup and maintenance of human body (Robinson, 1990). Vegetables on consumption provide minerals, vitamins, and fiber to the diet and are rich sources of minerals such as P, Na, K, etc. Intake of about 280 grams of vegetables per person is considered essential for maintenance of good health with intake of leafy vegetables (40%), roots and tubers (30%) and other vegetables (30%). Another major contribution of vegetables in human diet is in the form of fiber which is recommended from 25 to 30g per day per person.

Scope of vegetable growing in India

Vegetables have been vividly described in the Indian scriptures like „Vedas“ and „Ramayana“, constituting an important part of agriculture and nutritional food security. The Importance of growing vegetables lies in their fiber, trace minerals, antioxidants, vitamins, folacin, carbohydrates and protein content (Oomen and Grubben, 1978; Gormley, 1989), which are very crucial for a nutritionally balanced diet. Climatic conditions such as subtropical to tropical conditions of India offer a great scope for vegetable cultivation and a variety of vegetable crops can be grown in such a diverse conditions. Moreover recently there has been an increase in demand for processed vegetables, which is an opportunity for vegetable farmers for increasing their vegetable production to meet this demand. India is the second largest producer of vegetables in the world, after China, contributing 14% of world vegetable production. India is ranking first in the production of okra in the world contributing 73% of world production. Among all horticultural crops, fruits and vegetables together contribute about 92% of the total horticultural production in the country which shows majority of farmers in horticulture sector are engaged in fruits and vegetable cultivation, and thus they are very important and integral part of our economy. If one closely checks the consumption pattern of vegetables per person in our country then it's evident that per capita vegetable consumption in India is just 230 g as against 300 g Recommended Dietary Allowance (RDA), which is very low and in addition, we have a shortage of about 30 million ton of vegetables so it is need of the hour to increase vegetable production along with increasing availability of fresh and healthy vegetables to every household in the Country.

Production constraints

There are two antagonistic approaches which influence quality and quantity of vegetable production. First one is attack of insect pests and diseases and second is lack of proper pollination, when one tries to manage attack of insect pests and diseases through excessive and indiscriminate use of pesticides; it results in resistance, resurgence, residue and pollution. Furthermore, this indiscriminate use of pesticides cause harm to all non-target organisms including pollinators like honeybees, bumble bees, wild bees, etc. and this indirectly affects overall crop pollination and thus resulting in reduced crop yield (Bisht *et al.*, 1980, Rana and Goyal, 1991., Zhong *et al.*, 2004).

Way forward

In this situation the way forward is the Integration of two approaches in a way that both complement each other: managing crop pests using more selective and safer approaches and providing safety to non-target organisms such as pollinators for sustaining crop production. In addition we need to develop, validate and implement multipronged approaches in pest management, consisting of cultural, mechanical, host plant resistance/tolerance and biological control practices for managing crop pests and providing safety to beneficial insects i.e. pollinators.

Insect Pest problem: a major constraint in vegetable production

In vegetable crops insect pests are major constrain and causes significant yield loss during cultivation (Table 1). Losses due to pests in vegetables crops, on an average have been reported to range between 10-30%. And with an efficient pest management approach this loss can be made into a profit for the vegetable farmer. Some of the insect pests not only cause quantitative damage to crop, but also qualitative loss thus causing reduction in sale price of produce, and act as vector for several diseases: aggravating situation worst.

Table 1. Yield losses due to major insect pests in major vegetables:

Crop	Pest	Yield loss (%)
Tomato	Fruit borer (<i>Helicoverpa armigera</i>)	24-65
	Root knot nematode (<i>Meloidogyne</i> spp)	27.2
Chilli	Thrips (<i>Scirtothrips dorsalis</i>)	12-90
	Mites (<i>Polyphagotarsonemus latus</i>)	34
	Root knot nematode (<i>M. incognita</i> , <i>M. javanica</i>)	12.85
Okra	Fruit borer (<i>H. armigera</i>)	22
	Leafhopper (<i>Amrasca biguttula biguttula</i>)	54-66
	Whitefly (<i>Bemisia tabaci</i>)	54
	Shoot and fruit borer (<i>Earias vittella</i>)	23-54
Brinjal	Fruit and shoot borer (<i>Leucinodes orbonalis</i>)	11-93
	Root knot nematode (<i>M. incognita</i> , <i>M. javanica</i>)	16.62
Cabbage	Diamond back moth (<i>Plutella xylostella</i>)	17-99
	Caterpillar (<i>Pieris brassicae</i>)	69
	Leaf webber (<i>Crocidolomia binotalis</i>)	28-51
	Cabbage borer (<i>Hellula undalis</i>)	30-58
Bitter gourd	Fruit fly (<i>Bactrocera cucurbitae</i>)	60-80
Cucumber	Fruit fly (<i>Bactrocera cucurbitae</i>)	20-39
Ivy gourd	Fruit fly (<i>Bactrocera cucurbitae</i>)	63
Musk melon	Fruit fly (<i>Bactrocera cucurbitae</i>)	76-100
Snake gourd	Fruit fly (<i>Bactrocera cucurbitae</i>)	63
Sponge gourd	Fruit fly (<i>Bactrocera cucurbitae</i>)	50

Pollination requirements vis-à-vis improvement of productivity in vegetable crops:

Most of self-sterile crops are dependent on pollinators for successful pollination and this in turn determines the yield of the crop. While self-fertile crops are not that much depended on pollinators for fertilization yet it is reported that self-fertile varieties produce heavier and better quality fruits if they are cross pollinated (Free, 1993). Which means pollination by a pollinator is beneficial in both self-sterile as well as self-fertile crops, and it helps to improve quantity and quality of produce at the same time.

Increasing in productivity of vegetables and horticultural crops

Productivity of vegetable and horticultural crops can be increased by using improved agricultural inputs such as high quality seeds and planting material which are free of diseases, resistant to pest and are high yielding. Moreover, using Good Agricultural Practices (GAP) for better sustainability; and efficient and scientific use of fertilizers, pesticides and other chemicals also help us to obtain maximum yield with least damage to Mother Nature and non-target organisms including pollinators. This can help us to move forward to a better future with higher productivity and sustainability. Whatever low productivity we are facing now is mainly due to inadequate pollination. As more than 70% of the crops are cross fertile, special emphasis should be given in increasing the pollinator presence in the crop fields so that maximum yield potential can be achieved using pollinators. Effect of bee pollination on yield increase on several vegetable crops are provided below (Table 2) from which one can easily understand that multiple folds of yield increase can be achieved by increasing pollinator number in the crop field.

Table 2. Effect of bee pollination on yield increase of vegetable crops

Crop Plants	Yield /yield attributes	Yield increase (%)	References
Radish	Seed yield	22-100	Anonymous, 1997
Cabbage	Seed yield	100-300	Anonymous, 1997
Carrot	Seed yield	9.10-135.4	Alamet <i>et al.</i> , 1995
Carrot	Seed yield/umbel seed wt./umbel	926-1397	Alamet <i>et al.</i> , 1997
Turnip	Seed yield	100-125	Anonymous, 1996
Brinjal	Seed yield	35-67	Anonymous, 1996
Cauliflower	Seed yield	302-1338	Sinha and Chakrabarti, 1985
Onion	Seed yield	354-9878	Kumar <i>et al.</i> , 1989
Cucumber	Fruit setting	127-275	Krishansawmy, 1990
	Fruit weight	32.50-141.70	Ahmed, 1992
Squash	Fruit weight	771.40-4800	Alam and Quadir, 1996
Bottle gourd	Fruit setting	200-350	Alam and Quadir, 1996
Tomato	Fruit setting	8.3-27.40	Cribb, 1990

Pollination requirements and Insect pollination in vegetables

If we examine mode of pollination in vegetables, it is clear that some of vegetable crops are having hermaphrodite flowers and reproduce by self-pollination for example Tomato Lettuce Parsnip, Peas, Dwarf bean, etc. Few of the self-pollinated crops also show cross pollination to a certain extent and in these crops cross pollination may occur at an extent of 5 to 50 per cent.

While majority of the cultivated vegetable species are cross-pollinated and are mainly depended on pollinators for pollen transfer. The main vegetable crops which are cross pollinated includes cabbage, cauliflower, broccoli, brussel's sprouts, knolkhol, carrot, radish, beet, spinach, onion, amaranths, cucumber, muskmelon, watermelon, pumpkin, squash and other cucurbits such a as bitter gourd, bottle gourd, ridge

gourd, sponge gourd, snakegourd, point gourd, and ash gourd, etc. Some of the main pollinators for major vegetable crops are provided below (Table 3) in which honey bee, wild bees, bumble bees, flies, beetles, etc. are included.

Table 3. Insect pollinator of some major vegetable crops

Vegetable crops	Major insect pollinators
<i>Brassica oleracea</i> L. (Cabbage, Cauliflower, Brussels Sprout)	Honeybees (<i>Apis cerana</i> , <i>A. dorsata</i> and <i>A. florea</i>); Flies (Syrphidae, Calliphoridae, Muscidae) and small beetles are occasional visitors
<i>Abelmoschus esculentus</i> L. (Okra)	Honeybee (<i>Apis dorsata</i> , <i>Apis cerana</i>); bumblebees; Carpenter bees (<i>Xylocopa fenestrata</i> , <i>X. pubescens</i>); Euglossine bees (<i>Lasioglossum</i> sp.); <i>Halictus</i> sp.; <i>Chalicodoma flavipes</i> and <i>C. lanatum</i>
<i>Allium</i> spp. (Onion)	Honeybees, solitary bees, dipterans
<i>Daucus carota</i> L. (Carrot)	<i>Halictus splendidulus</i> , <i>H. vachallii</i> and <i>H. himalayensis</i> ; <i>Allodape</i> sp.; <i>Nomioides</i> sp.; honeybees (<i>Apis mellifera</i> and <i>A. cerana</i>); Halictid bees (<i>Halictus</i> sp.) <i>Lasioglossum</i> sp.)
Tomato	Honey bees, Wild bees, halictid bee (<i>Augochloropsi signita</i> Smith), bumble bees (<i>Exomalopsis glubosa</i>), wild solitary bees (<i>Anthophora urbana</i>).
Watermelon	Honey Bees, bumble Bee, and different species of bees (<i>Apis mellifera</i> L., <i>Halictus</i> spp. <i>Augochlorella gratiosa</i> Smith, <i>Agapostemon splendens</i> Lepageletier, and <i>Augochloropsis caerulea</i> , <i>Apis cerana</i> , <i>A. Florea</i> , <i>Melipona</i> spp. and <i>Tigona iridipennis</i>)
Pumpkin and squash	Honey bee, wild bees (<i>Peponapsis</i> spp. and <i>Zenoglossa</i> spp), cucumber beetles (<i>Diabrotica</i> spp.), scarab beetles, meloid beetles, flies and moths.
Muskmelon	Honey bees, ants and thrips.
Cole crops	Honey bees, wild bees, and flies. Bees of the family Andrenidae, Megachilidae, and Nomadidae more important than honey bees in the pollination of cabbage (<i>Bombus</i> , <i>psithyrus</i> and wild bees).
Carrot	Flies and Bees. Most of the species of visitors were in the superfamily Apoidea, or the Ichneumonidae, Psammocharidae (Pompilidae), Sphecidae, and Vespidae families of the Hymenoptera, and the Bombyliidae, Sarcophagidae, Stratiomyidae, Syrphidae, and Tachinidae families of the Diptera.
Bitter gourd	Small bees

Pollination for Hybrid Seed Production

Pollination is one of the most important aspect in hybrid seed production units and honeybees are one of the most trusted insect pollinators for production of hybrid seeds. Hybrid seeds of onion, cabbage, cauliflower, carrot, cucumber, etc. are produced mainly using honey bees are pollinators.

Pollination in Green Houses/cages

Pollination in small enclosures like green houses or cages can be achieved by using bumble bees because they work well under small enclosures and they can be readily obtained from flowers or by collecting nests. It is also reported that use of honeybees has increased pollination rate in brussels sprout, muskmelon, onion, runner bean, tomatoes, etc. in green houses or in large pollination cages. Other than bumble bees and honey bees, solitary bees, syrphids and blowflies can also be used in green house for crop pollination.

Declining trend in pollinators

Birds, bees, bats and other species that pollinate plants life are declining at an alarming rate, which has threatened the existence of plant life and this downward trend could harm dozens of commercially important crop cultivation. This decline in pollinator populations is one form of global change that actually has credible potential to alter the shape and structure of terrestrial ecosystems. The decline in pollinator

diversity and population presents a serious threat to agricultural production and conservation and maintenance of biodiversity in many parts of the world. One indicator of the decline in natural insect pollinators is decreasing crop yields and quality despite necessary agronomic inputs.

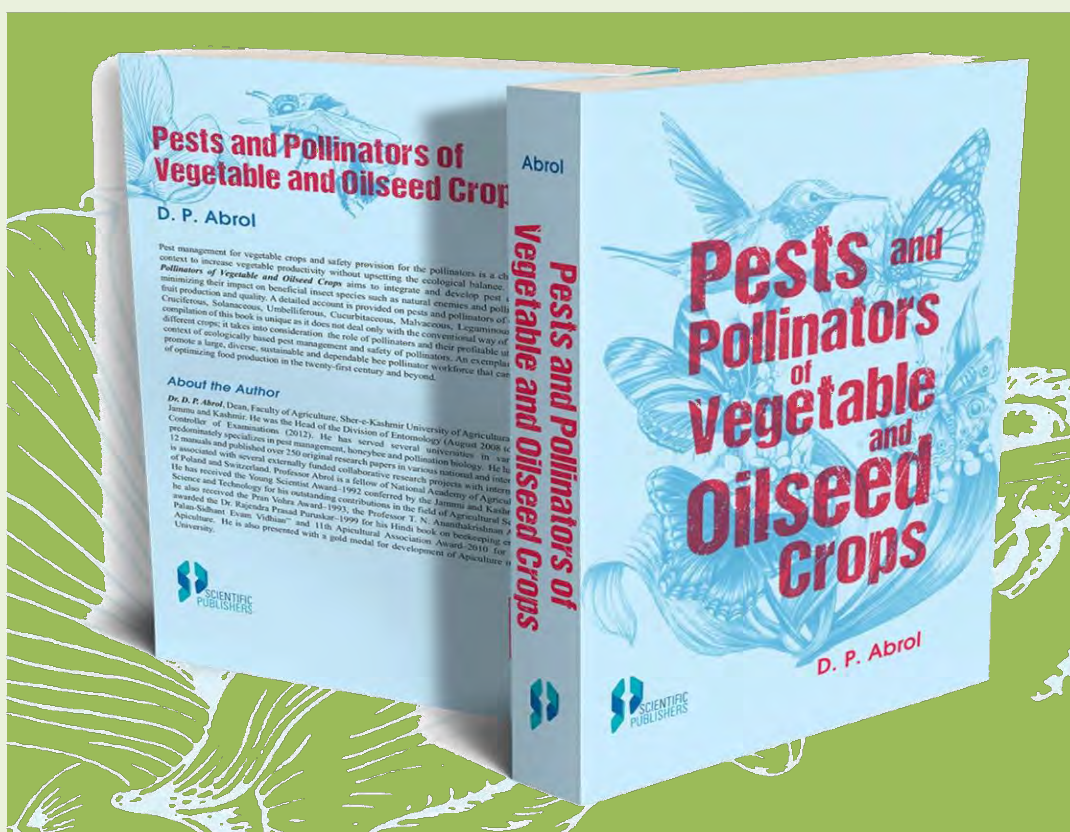
Future impact of declining pollinators

According to FAO estimation, the decline of pollinators would have effects on main three crops categories; fruits and vegetables are especially affected with a loss of €50 billion each, followed by edible oilseed crops with €39 billion. A 100% decline in pollinator services could reduce global fruit supplies by 22.9% (19.5-26.1), vegetables by 16.3% (15.1-17.7), and nuts and seeds by 22.1% (17.7-26.4) and 71 million people in low-income countries could become newly deficient in vitamin A. Pollinators' decline has a direct impact on the stability of food production and consumer prices. A decrease in fruit and vegetable availability could impact on the health of consumers worldwide. The World Health Organization (WHO) has set a lower limit of 400 grams per capita per day for fruit and vegetable consumption. Some studies demonstrated that even now more than 50% of the households fall below this recommendation.

Conclusion

Declining horticultural productivity can be attributed to a number of factors, but pollination plays a crucial role in keeping up quantity and quality of produce. Despite use of improved agricultural technologies, without pollination, neither fruit nor seed will be formed. There for while attempting to manage vegetable pests, safer and selective approaches should be implemented which are safer to pollinators. Inadequate pollination can be overcome by planned pollination program, which means that supplementing crops with managed honeybee colonies in required numbers at desired, places will be required in future to improve yield. Promoting use of beekeeping for pollination of horticultural crops will be of benefit to both the beekeeper and to the farmer. Active participation of researcher and extension specialist will help in expansion of use of honey bee rearing for crop pollination.

(References not provided herein)



Food Safety – A Major Concern for Fresh Vegetables

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In recent times, consumer acceptance of fresh vegetables is largely governed by their status of food safety and traceability. The assessment of food safety mainly involves testing of vegetables for the residues of a wide range of pesticides, which might appear in the crop as a result of direct agricultural applications or from indirect sources, eg. spray drifts from adjoining crop fields, contaminated agro-inputs, etc. The residues of these food contaminants in the raw agricultural commodity are mostly regulated at their maximum residue limits (MRLs) or analytical limits of quantification. In India, MRLs are recommended by FSSAI. Internationally, MRL recommendations are available from *Codex Alimentarius Commission*, European Commission, and many other country-specific regulatory agencies. The authorized applications of pesticides in a crop field are governed by label claims with CIB & RC. Unfortunately, in India, for most of the vegetable crops, the number of pesticides with a label claim is few. In some cases, e.g., curry leaf, drumstick, coriander leaf, etc., the crop does not have a single pesticide with a CIB & RC label claim. In view of these limiting situations, the farmers cannot maintain the sufficient waiting period to ensure dissipation of an applied pesticide to MRL before a crop is harvested. This in turn might result in accumulation and detection of pesticide residues in vegetables at harvest.

Novel technologies with regard to food safety and traceability applications are being continuously developed across the country to improve quality and safety of Indian vegetables. The success of implementation of a food safety-traceability system comprises recommendation of a dynamic package of practices, which includes pest-specific list of suggested chemicals with their application rates and pre-harvest-intervals, after which the residues are expected to dissipate to below the respective MRLs. The objectives of this lead talk are to: (a) present the current food safety status of Indian vegetables and (b) highlight the regulatory efforts in the country in developing good agricultural package of practices to facilitate safe use of pesticides in vegetables. The presentation will also briefly inform how implementation of traceability and good agricultural practices is helping in minimizing the detection of pesticides, and enhance the overall quality of fresh vegetables in India.



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Vegetables Primary Processing & Marketing: Case Study of Retail Industry

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Retail market in India is estimated to reach US \$ 1.1 trillion by the end of 2020, with modern trade expected to grow at 20% annum. Organized retailing refers to trading activities undertaken by licensed retailers. These include the corporate-backed hypermarkets and retail chains, and also the privately owned large retail businesses. Major types of retail outlets, are hypermarket, discount stores and supermarkets. Location of retail outlet plays an important role for the success of any vegetables retail outlet. The retail chain has a business development team, which has the responsibility to identify a suitable place for starting a store. This store area is generally leased out rather than purchased. So that if the catchment area comes out to be of less potential, it is easier to shift the location. Once the area is identified the construction work starts. The visual merchandise team does the interior planning of the store in consultation with the merchandisers, the planogram of the store is finalized accordingly the racks are fitted. The vegetable category is a very challenging category among all the other segments within a store. To have a control on raw material the retail organization establishes direct connects with the farmers. The process starts with, the store initially generating demand for vegetable one or two day before the actual supply. This indent is based on the estimation of sales and existing stocks. The sales estimation is arrived at by looking into the previous sales data and also considering festival/ seasons existing offers and prices. Once the indent is received then it is compiled by the vegetable category manager in which he also checks and verifies the indent and makes necessary changes after discussion with the store manager this indent is now compiled from all the stores. The indent is procured from 3 sources namely local collection centre, national procurement and vegetable *mandis*. Transfer in and transfer out are one of the important process in retail for stock matching generally transfer out is done by the distribution centre. After the stock is received by the store, it does transfer in. During stock take the inventory is estimated based on transfer in minus sales similarly for the stock take off distribution centre or warehouse it will be transfer in in minus transfer out by the loss prevention team. Vegetables retail in India is still new and people need to get adapted to the changing trend, moving away from the mom and pop stores to modern retail or online platforms.

Introduction

Retail is the activities of selling goods direct to the consumers, usually in small quantities as compared to wholesale which usually deals in bulk, retail is majorly breaking the bulk to small quantity as per consumer requirements. Retail market in India is estimated to reach US \$ 1.1 trillion by 2020 from US \$ 700 billion at present, with modern trade expected to grow at 20% per annum due to huge consumer base. Foreign direct investment (FDI) in the retail sector in India is restricted. In 2006, the government eased retail policy for the first time, allowing up to 51% FDI through the single brand retail route. Organized retailing refers to trading activities undertaken by licensed retailers, that is, those who are registered for sales tax, income tax, etc. These include the corporate-backed hypermarkets and retail chains, and also the privately owned

large retail businesses. Some important players in the food retail industry are: Future Group- Food Bazaar, Spencer Retail, Reliance Retail, Bharti Retail, Aditya Birla More, Tata Star Bazaar etc.

Types of Retail outlets

Hypermarket: A Hypermarket is a format which offers wide range of products to the end-users under one roof. It ranges from 50,000 to 1,00,000 sqft in area. It meets almost all shopping needs like Electronic Appliances, Apparels, Jewelry, Toiletries, Cosmetics, Footwear, Sportswear, Toys, Books etc. Examples - Shoppers Stop, Pantaloon

Discount Stores: Discount stores also offer huge range of products to the end-users but at a discounted price, almost same as departmental store but at a cheaper price.

Supermarket: A retail store which generally sells food products and household items is called a supermarket. It ranges from 2000-5000 sq.ft.in area. A supermarket is an advanced form of the small grocery stores and caters to the household needs of the consumer. They sell Bakery products, Cereals, Meat Products, Fish products, dairy, eggs, Breads, Medicines, Vegetables, Fruits, Soft drinks, Frozen Food etc.

Merchandising Categories

Merchandising refers to the marketing and sale of products that stimulates interest and attracts customers to purchase. The main characteristics of a retail product assortment are (1) its length or number of products, (2) its breadth or number of product lines, (3) its depth or number of product varieties within a product line and (4) its consistency or how products relate to each other in a retail environment.

- ✓ General Merchandise: It includes merchandise, such as dry goods, garments, footwear, furniture, home furnishings etc.
- ✓ Personal care: Soaps, Cosmetics, Personal hygiene etc.
- ✓ Fruits and vegetable
- ✓ Staples and dry fruits
- ✓ Bakery frozen dairy and poultry
- ✓ Ready to Eat
- ✓ Garments etc.

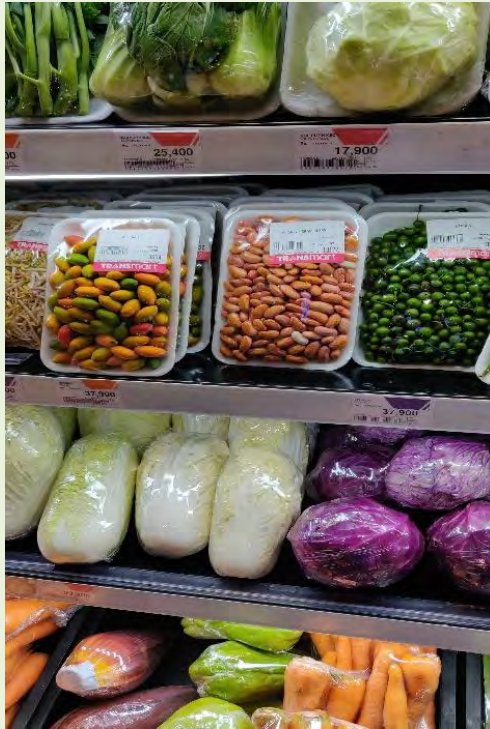
Location

Location of retail outlet plays an important role for the success of retail outlet. That is why we see an outlet with almost similar merchandise has different sales volume mostly due to its presence in a potential location. The retail chain has a business development team, which has the responsibility to identify a suitable place for starting a store this store area is generally leased out rather than purchased. So that if the catchment area comes out to be of less potential, it is easier to shift the location. Once the area is identified the construction work starts. The visual merchandise team does the interior planning of the store in consultation with the merchandisers. The planogram of the store is finalized accordingly the racks are fitted.

Procurement and Distribution

The procurement process starts initially by generating demand of vegetable one or two day before the actual supply. This indent is based on the estimation of sales. The existing stocks are estimated, the store manager also looks into previous sales data. He also considers festivals, seasons, existing offers, and existing price of the vegetables. Generally the sales of vegetable are similar to the corresponding week, month or year before sales. It gives a good estimate. Certain festival like *Uttaran* in Gujarat will increase the sales for raw *tur fali*. Similarly coconut and flowers during Puja seasons. During *Ramzan* and *Navratri* there is increase in fruit sales. Based on these factors the store manager indents vegetable for coming days requirement

Once the indent is received, then it is compiled by the vegetable category manager in which he also checks and verifies the indent and make necessary changes after discussion with the store manager. This indent is now compiled from all the stores by local distribution centre manager. S/he prepares the procurement plan for each commodity.



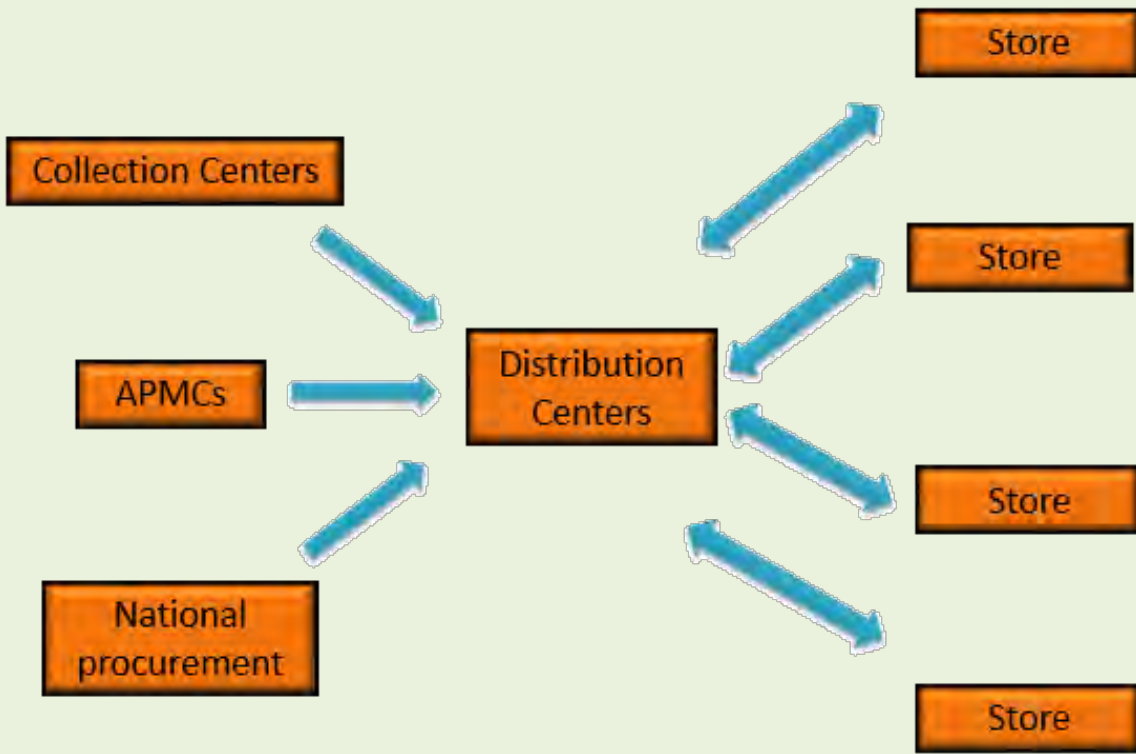
Typical Indian vegetable *mandi*

Display of vegetables as per planogram

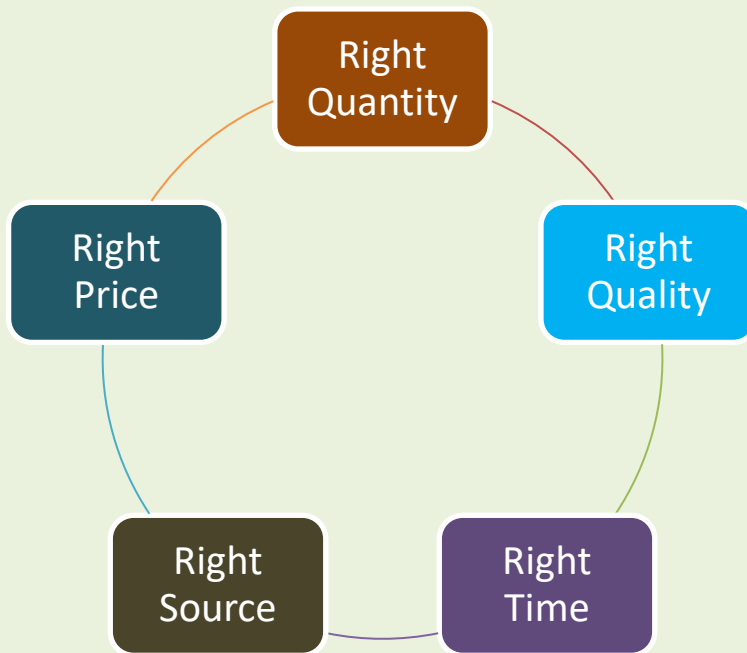
Three major sources of procurement are

1. Local collection centre located in the source of vegetable
2. National procurement mostly for vegetables like onion from Nashik, potato from UP
3. Vegetables *mandis* which is generally the market located in the outskirts of the city and open during the night time 11 p.m. to 5:00 a.m.

Collection centre is meant to supply the needs of the stores for vegetable types, grown in its territory. The collection centre in-charge identifies which vegetables are grown in his surrounding and its potential quantity. He also has a verbal agreement with the farmers to supply vegetables to the retail chain when required. Based on the requirement received from the distribution centre. The collection centre in-charge informs the farmers to bring the required quantity. The weighing is done and the payment is made on the basis of prevailing or previous day *mandi* prices. National level procurement for the retail chain is done by establishing, a national procurement division in the main production zones of vegetables. Many of the retail chains, have procurement centres in Nashik for onion, Ratnagiri for mangoes, and potato in Kolkata. The quantity is estimated, for the whole year during the harvesting season. After purchasing at lowest price, it is stored in the cold storage to meet the national level retail store requirements. The balance quantity of indent quantity left after national and collection centre procurement is fetched from the *mandi*. The *Mandis* generally open in night after 11 pm till 5:00 am in the morning. It is located in the outskirts of the city. So as to ensure smooth traffic in the city and eliminate big vehicles creating traffic issues during the day rush hours. Generally the distribution centre identifies the traders and commission agents in *Mandi* to procure vegetables on the behalf of retail chains.



Procurement and Distribution of vegetable



Five important aspects of good vegetable procurement

After the total quantity ordered by the stores is procured by the distribution centre. In the early morning hours the batch making process starts with grading and sorting. The leftover is used for cut vegetables. Now the batch making process starts. In this various types of vegetables are filled in two types of plastic

trays, one with the capacity of 20 kg and other 8 kg based on the type of vegetables to avoid storage and transportation damage viz. onion and potato are kept in 20 kg capacity crates whereas tomato is kept in 8 kg capacity crates. The loading is done in the vehicle which now moves to stores to reach by 7:00 a.m., as per a pre-decided route plan. The stocks of one store from other one is demarcated in the vehicle by means of a colour coded ribbons, so that it is easy for unloading. The stocks are unloaded by the store staff. The quantity received is tallied with the Transfer In (TI) receipt from distribution centre and indent. The quality is also checked by the store staff. Thereafter cleaning of the display area is done and vegetables are displayed for customers to pick up. On the return route the vehicle collects empty crates and left over vegetables from the store back to distribution centre.

Store Operations

The store opens at 6:00am by assistant store manager or store manager by taking the key from security guard after signing the key register. The store is then cleaned by the housekeeping staff. The assistant store manager or store manager runs the start of day IT operations. This process helps in uploading the current prices, offers, and stock information in the back office, cash counter and head office. The price stickers of the changed vegetable prices and offers are put on the racks. Generally most attractive offers are put in the end caps or corner racks. High profit margin vegetables are generally kept in eye level. High ethylene producing vegetables like onion garlic etc. are kept away from ethylene sensitive vegetables like brinjal, and bhindi. The fresh leafy vegetables and lemon are kept over most cloth to avoid drying. The big banana bunch are cut into 4 to 6 pieces bunch and displayed attractively. Colorful vegetables are kept in top rack so that they get reflections from mirrors to appear full and beautiful. Empty cartoons and boxes are also used for display to give appearance of abundance. Such good display techniques attract customers beside offer and low prices. Cut vegetables are kept in Open Door Chillers (ODCs). The customer picks the vegetables and weighs in barcode generating machine before reaching to the cash counter. There are also express cash counters to improve speed in vegetables purchases.

Inventory Management

Transfer in and transfer out are one of the important process in retail for stock quantity matching. Transfer out is done by the distribution centre for the stock going out of the distribution centre. After the stock is received by the store, it does transfer in their computer system. During stock take exercise, the inventory is estimated based on transfer in subtracted by sales volume. Similarly for the stock take also takes place in distribution centre or warehouse. The loss prevention team conducts this stock take in regular intervals generally after the store is closed. To estimate the shrinkage, which may be due to theft or poor inventory control. If it is beyond certain point actions are taken against staff.

Conclusion

Sales of vegetables get seriously impacted due to factors like rain, strikes, political events etc. resulting into leftovers which goes as waste often termed as dump. The profitability in vegetable segment is a great challenge for the retail chains due to the high dump quantity. Higher dump in a store may be due to poor indent process. Generally the merchandisers sets up a margin of 20% profit after including all costs and after benchmarking with other similar nearby stores. But suppose there is dump of 10 - 15% in addition to shrinkage, weight loss due to moisture loss. Sometimes the leftover stocks are sold with markdown prices in the evening for left over stocks. There is hardly any profit for the retail chain from vegetables segment. It can become profitable if there are trained skilled staff to take good care of stocks, with feeling of ownership and procurement process is efficient. Overall in vegetable retail is seen as a less profit making segment, but still it is most important segment. Because, it ensures highest footfalls in the store, necessary to build customer loyalty.

Impact of Covid-19 on Agriculture including Food, Veggie and Fruit MSMEs

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The agriculture industry represents an important component of the Indian economy both in terms of its contribution to the GDP as well as a source of employment to the majority of the country's population. This sector is currently showing immense opportunities, with India presently being one of the world's largest agricultural producers by value.

A number of transformations have taken place in this sector over the past few decades. These include - rising penetration of the organized sector, growth in contract farming, agriculture becoming more mechanized, easy loan facilities, rise of exports, use of agrochemicals and high yielding seeds, and an increasing role of the private sector in processing, branding and marketing, etc.

There will be impact of Covid-19 on Fruit, veggie also. As per secondary data analysis India's fruits and vegetable exports are likely to decline by 30-40 per cent during the ongoing grape and mango season due to global lockdown that has been implemented to prevent the spread of the coronavirus (Covid-19) pandemic.

Farmers have prepared early mango crops - *Hapus* or *Alphonso* varieties for exports. Many in the Sindhudurg district of Maharashtra (the hub of *Hapus* mango production) had kept their consignments ready for delivery. Several enquiries were received before the lockdown. We hope the government will open exports with some riders. But, most importing markets are shut and this will make it difficult to executing orders. Thus, exports would certainly be hit," said Abid Raien, Director, Raien Fresh Produce, a Navi Mumbai-based fruit and vegetable exporter.

Many exporters have estimated a 30-40 per cent decline in exports this season, as by the time markets open, grape season would be over. Most of the mango export season would also be lost. The fruit and vegetable trade across India is gradually coming to a standstill due to sealing of state and district borders, which has hit plying of trucks and other carriages to *mandis* throughout the country. Even after easing the rules, these exporters have not become active. They have to protect themselves and also manage cancellations of orders.

Data compiled by the government-owned Agricultural and Processed Food Products Export Development Authority (APEDA) showed a 16 per cent decline in India's fruit and vegetable exports at \$1 billion for the period between April 2019 and January 2020, from \$1.19 billion for the same period the previous year.

India's fruit and vegetable exports are expected to be hit badly as major import countries including the Middle East, China, United States and European Union, all of which are struggling to deal with Covid-19.

Meanwhile, the European Union has eased its norms for import of fruits and vegetables from India under which Indian exporters do not require to submit a physical certificate assuring food safety and animal and plant health standard. Now an online certification will be sufficient.

The first visible impact of COVID-19 in the rural sector is on the agricultural supply-chain. While the government has issued permits to trucks allowing them to carry groceries, fruits, and cereals, a large number of transporters are yet to receive their permits. This has increased the time taken for the farm produce to reach the market. On the other hand, there is a slight impact on the demand side as the restaurants have been ordered to shut down for the interim period. This is causing a sizeable revenue loss to many farmers across states. As per a published report, the railway ministry suggests that freight loading has dipped from a usual 10,000 cargo rakes per day to just about 3-4,000 now. As a result, the farmer has to sell his crop at a cheaper price, settle with a lower profit.

The second impact of COVID-19 is the delay in sowing and harvesting of crops due to the unavailability of products such as seeds, tractors, ancillary support, medicines for crop protection. Traditionally, this is the best time for brands from the above-mentioned sectors to market their products to the farmers. Even the e-commerce brands in agriculture have been impacted as the transportation of these products have stopped and there is no inventory.

The third impact of COVID-19 is the expected job cuts in the agricultural sector. As per the government, there are nearly nine crore farmers along with a similar number (if not more) landless agricultural labour. While the farmer will be receiving relief from the government directly, the latter is placed in a difficult position at this time.

The fourth big impact is the complete shutdown of exports. India has been a major exporter of crops and as per APEDA, India's overall agri-exports in 2018-19 were to the tune of Rs 685 billion. Currently, all the ports have been locked and huge inventory has piled up with the traders and farmers.

The fifth impact is on the MSME & SME's. These include small industry units, businesses/traders, and shops that manage a decent size inventory and employ numerous direct and indirect employees. Post lockdown, their businesses are shut down and facing a revenue hit. They may have to let go of their employees for a variety of reasons including financial viability, migration, health and other. People stand to lose jobs without a clear idea of when the situation is going to stabilize.

The sixth impact is the prediction of a weak consumption trend post COVID-19. Once things return to normal, the primary focus of people would be to secure jobs and get their businesses going. During such time both families and businesses will be keeping stringent checks on their spending patterns. This trend will also be an impediment to the expansion plans of the global/national brands giants in this region. They will take a while before reconsidering their entry to this market. It is nearly impossible to even put a ballpark figure to the kind of financial hit rural areas would take due to the COVID-19.

Situation is alarming. No vaccine yet. Social distancing, wearing masks, sanitisation, cleaning of hands in regular intervals are the new normal. Hygiene and management at work place to follow govt. guidelines or face action. We have to live with corona and at the same time to run businesses

Recently Hon'ble Prime Minister Narendra Modi held the second round of meeting with the chief ministers on the Covid-19 situation where he made it clear there will not be any further lockdown in the country. PM Modi also said that they need to think about „Unlock 2.0“ and also ways to minimise infection.

The COVID-19 pandemic has caused high stress on MSMEs, putting their continuity at risk. They are looking to government to provide support and relief. This includes tax concessions, easy access to credit, GST write-offs, and reimbursement or concession for wage-guarantee. Govt has responded with stimulus package.

As you are aware that MSMEs are the backbone of our economy which contributes 30% to GDP, 98% of industry share and generate 70-80 % of employment. Out of that 95% constitutes Micro having turnover of less than 5 Crores.

In a series of combining several structural reforms, fiscal and liquidity measures, Prime Minister Narendra Modi announced economic package to support businesses including MSMEs and society to combat Covid-19 crisis. He calls for **Atmanirbhar Bharat** or Self-Reliant India Movement. Clarified **five pillars of Atmanirbhar Bharat** – Economy, Infrastructure, System, Vibrant Demography and Demand. **Special economic and comprehensive package** of **Rs 20 lakh crores** - equivalent to **10% of India's GDP**. The package to **cater to various sections** including cottage industry, MSMEs, labourers, middle class, industries, among others. **He emphasized bold reforms** across sectors will drive the country's push towards self-reliance.

It is time to **become vocal for our local products and makethem global.**

This is an opportunity for businesses including food MSMEs.

Supply Chain Challenges of Fresh Fruits & Vegetables

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Fresh fruits & vegetables hit the headlines when the tomato prices cross 80 Rs/- or onion brings tear to the housewives. Researchers love to write articles on losses in fresh fruits and vegetables to the tune of 30-40%. Most causes of farmers suicides are also linked to no or low returns from the farm produce. The news of tomato selling at Rs 2/- or potato thrown in the highways are also not uncommon. When the retail sector opened up, people thought that the scenario would change when investments pours in to the fresh retail segment. But nothing has changed significantly.

The fruits & vegetable (F&V) supply chain is characteristically complex and complicated. More than the transportation and logistics, there are other factors which impact the supply chain. Most of these products are highly perishable, strongly price volatile and uncertain on demand. Supply side is marred by seasonality, cyclicity and climatic conditions of different geographies. There is very little value addition in the fresh business except for sorting, grading and packing. The industry comprises of largely unorganized trade to an extent of 99%. The obvious question is why organized players do not step in.

To manage a retail supply chain for cauliflower in Delhi one has to source it from 5 different geographies during a year. These geographies are spread from 6 to 600 kms, 700 to 7000ft (above sea level) or from the deserts of Rajasthan to hills of Himachal. The variability's are such that one has to create a supply chain every alternate month only to be broken in the next month. The prices also vary from 10 Rs/ to 100 Rs/-. So can the frozen cauliflower be a substitute when prices are high. No, as long as fresh is available, frozen has little preference. People might reduce quantity to adjust the budget but still not replace it with frozen.

It is said that less than 4% of India's fresh produce is transported by cold chain, compared to more than 90% in the UK. Refer transportation as solution to the post-harvest loss is easier said than done for the

simple reason that we do not have end to end cold chain. The last mile connectivity or the hawkers/ vendor do not have the infrastructure of cold chain. The fruits & vegetable (F&V) which is moved in refer & brought on to ambient environment deteriorates faster. Additional cost load of cold chain is also not competitive either. The solution therefore is not cold chain but the ventilated, air circulated & humidified transport. There is a wide range of traditional packaging adopted for transportation of different items like bamboo basket in combination with banana leaves at Barpeta in Assam, wet gunny bags with ice cubes for beetle leaves in Orissa, wooden boxes with straw for *Alphanso* mango at Ratnagiri. These are traditional, low cost, and highly efficient in preserving F&V during the transit. But not much research has taken place to standardize these for logistic requirement or accounting requirements.

Small farmers keep growing different vegetable in different season throughout the year. But unless the area develops as a cluster for particular crop which produces significant quantity for a period of time, the markets do not develop nor it becomes logistically viable. Over a period of time commodity *mandis* have developed in some clusters for specific commodities like onion at Nashik, tomato at Kolar or potato at Agra. But these are only a few. Many of the F&V *mandis/ hats* in north and east are a mix of all vegetables with very small lot size in kilograms. A lot of aggregation is required for export of these to distant places. The uniformity of quality in such cases is very low leading to very poor returns. Most of the *mandis/ hats* of Bihar, Bengal and Assam are of this nature.

Another easy solution suggested most of the time is “eliminate the middleman or de-layer the supply chain”. It is easy to delayer the chain but not easy to delayer the costs. Formal organizations often add costs; there are delays in decision making and are bound by legality or organizational rules. F&V deteriorates and deteriorates at a faster rate as time passes. Losses piles up with passage of time. So most organised players tend to lose for the reasons of organization. While the small player/ vendors are efficient in operation but it is very difficult to scale up or replicate their operations.

Farm acreage sown is largely based upon the previous years” return and not on the future opportunities of sale. Farmer is always tempted to sow more if he has a good previous year’s earning and also the vice-versa. As a result of this there are cyclical supplies of high & low availability. This leads to sharp rise or fall of prices. When there is disproportionate rise of prices many speculators, traders or hoarders get in to the trade making it more complicated and unreasonable. The trade gains on uptrend situations while farmers loose on down trend. There does not exist any formal or informal planning mechanism as to how much to be sown and when to be sown or where to be sown.



Farmers seldom realize the right value of the produce as they do a very little on post-harvest management of sorting, grading & packing. There are also issues of standardization of packing across the country even for the major fruits and vegetables. Most of the government initiatives are directed towards creating production technology and very little on post-harvest and marketing initiatives. However there are some developments that have picked up momentum like use of standard boxes in apple trade in Himachal or use of crates in tomato trade of Nashik or the grading done by the farmers for *Alphanso* mango. Government needs to direct investments more on the marketing of produce more alike Washington apples. It also has to regulate on cropping area for better availability of fresh produce for the consumers and better price realization for far.

Author has worked for more than 28 years in the sourcing & supply chain function in the agri-food industry. He has a varied experience in the entire food-chain from crop production, procurement, food processing as well as food retailing. He has rich organizational understanding, worked in multinational companies (PEPSICO), cooperative (OIL ORISSA), private (ADITYA BIRLA) as well as quasi-government (MOTHER DAIRY) organizations. His commodity experience spans across a host of commodity categories like cereals, pulses, spices, edible oil & flavors. His latest & most challenging assignment is managing fresh Fruits & Vegetables supply chain. His expertise revolves around creating agrarian value chain, thereby connecting farmers with markets. On his current profile he is working directly with farmers across 20 states of India.

Decentralized Cold Storage System - A Boom for Small & Marginal Farmers



Vikash Kumar Jha & Debashis Mohapatra

Context

In pre-independence era, the area under horticulture (**fruits and vegetables**) was about 2.5 per cent and that under oilseeds and non-food crops was about 20 per cent. If we compare this to present day, net sown area is of 141 million hectares, around 55 per cent of the area under cereals. **Horticulture** now accounts for 16 per cent of net sown area. The nation's livestock population counts at more than 512 million. Hence, agriculture scenario has diversified over the decades¹.

The farmer, remain in frequent distress, despite higher productivity and production. The Government has constituted an Inter-Ministerial Committee for doubling of farmers' income and recommends a strategy to achieve doubling of farmers' income in real terms by the year 2022. 75% of farming community are marginal farmers and with less than 1 hectare land (~93.8 million marginal farmers) and average land holding size is 0.38 hectare. So, research and technology development need to focus on issues of marginal farmers, as they are likely to be the driver of growth of agriculture for next few decades and can contribute to achieve \$ 5 trillion economy by 2025 from current level of \$ 2.94 trillion.

Small and Marginal farmers face many issues in production, post-harvest management and selling of agriculture produce as their land size is small, so big tools and implements suitable for big farmers are not suitable or affordable by them, also small marketable surplus create a low bargaining power. if farmer is producing perishable commodity like fruits and vegetables, then bargaining power further reduced, as they can neither access to big cold storage, which are always far away and nor have their own cold storage option. So all these factors lead to further marginalization of farmer's economic capability.

A startup of IIT Mumbai named as "RuKart Technology Private Limited" (hereafter RuKart), Mumbai, has sincerely tried to innovate/ Re-Design technologies solutions for small and marginal farmers to address production, protection & post-harvest issues for different crops through a) combining treadle pump, water

¹ Report of the Committee on Doubling Farmers' Income Volume I "March of Agriculture since Independence and Growth Trends (<http://farmer.gov.in/imagedefault/DFI/DFI%20Volume%201.pdf>)

storage and Drip Kit, b) individual capacity solar dryer, similarly c) zero energy ventilation chambers for arresting post-harvest losses of fruits and vegetables for at least 3-7 days, d) safeguarding standing crop from invasion of wild animals by using Peek-Rakshak (solar blinking light) and e) Micro-solar dryer for a marginal farmer's household.



Banana packed for transportation in Baisali Bihar



Traditional grain storage structure in Purnea Bihar

ZEVCC: (Sabji Cooler)

India is the second largest producer of fruits and vegetables in the world after China. Production of fruits and vegetables account for 259 million tons (MT) of which 90 MT & 169 MT are fruits & vegetables respectively (2015-16). Storage of fresh horticultural produce after the harvest is one of the most pressing problems of India. Due to their high moisture content, fruits and vegetables have a very short life and are liable to spoil. Moreover, they are living entities and carry out transpiration, respiration and ripening even after harvest. Metabolism in fresh horticultural produce continues even after harvest and the deterioration rate increases due to ripening, senescence, and unfavorable environmental factors. Hence, preserving horticulture produces in their fresh form demands close control of space temperature and humidity (Chandra et al., 1999). Due to the short shelf life of horticulture produces, it is estimated that about 30 to 35% of India's total fruits and vegetable production is lost due to spoilage during operation like harvesting and storage (Basediya et al., 2013). The fruits and vegetables, being perishable, need immediate post-harvest attention to reduce the microbial load and increase their shelf life, which can be achieved by storing them at low temperature and high relative humidity conditions. These conditions are usually achieved in cold storages. However, cold storage technology is very costly and most of them are situated either in the big cities or district headquarters, so generally not accessed by small and marginal farmers. Mechanical refrigeration is energy intensive and expensive, involves considerable initial capital investment, and requires uninterrupted supplies of electricity which are not always readily available, and cannot be quickly and easily installed. Also available cold storage in India is used primarily for the storage of potatoes. Appropriate cold storage technologies are therefore required for storage of fresh horticultural produce in remote and inaccessible areas, to reduce losses due to spoilage. An affordable and environment- friendly energy free cooling structure named as zero energy vegetable cooling chamber (ZEVCC) has been developed by RuKart. The importance of this technology lies in the fact that it does not require any electricity or power to operate and hence it is free from any recurring cost. The cooling chamber temperature is less than ambient temperature by a margin of 5-15°C (depends on ambient relative humidity) and maintains the high relative humidity of above 85% - 90% inside the cooling chamber. The low temperature & high humidity inside the chamber preserve vegetable crop (non-tuber crop) for short-time – on an average 5 to 6 days. Evaporative cooling is a gift of nature - principle depends on cooling by evaporation. When water evaporates, it draws energy from its surroundings producing the considerable cooling effect. This occurs when the air that is not too humid passes over a wet surface; the faster the rate of evaporation the greater the cooling. But when the air is totally saturated with water, no evaporation can take place and no cooling would occur. This type of cold storage is most suited in a climate with relative humidity less than 50 %. The nitrogen filled ball and Galvanised Iron (GI) tank based structure proved to the most efficient than the other designs of traditional cooling chambers like double brick walls, pot-in-pot structures etc.



Zero Energy Vegetable Cooling Chamber in Umred Taluka, Nagpur (Source: RuKart)



All vegetables tomato, brinjal, beans, chili, cauliflower & cabbage can be stored

It is found that farmers found ZEVCC quite attractive and affordable. More than 75 such units have been already installed across India; 6 units in Banka District (Bihar), 2 units in Yavatmal District (Maharashtra), and 3 units in Umred taluka (Nagpur District, Maharashtra) and 41 unit in Odisha (20-Gajapati, 5-Jharsuguda, 6-Mayurbhanj, 6-Koraput, 14-Kalahandi and 15-Sundargarh district) without any subsidy support of Government. Size of ZEVCC is constructed as per the capacity requirement (100 to 250 Kg). Only watering once in a day is required. Minimum maintenance expenditure is required. It can retain the freshness of fruits and vegetables for about 5-6 days. Leafy vegetables can be kept for 2 to 3 days. This is the only on-farm storage technology available for a marginal farmer. It is affordable for a farmer compared to other available storage technologies. A farmer can perform repair & maintenance (R&M) service. No formal training is pre requisite for R&M activities.

Ratna Majhi is a small farmer from Mahijhar village, Talbegaan GP of Bhawanipatna Sadar block of Kalahandi district. He is a happy farmer for having a sabji cooler and it is meeting to his expectation and already kept 60 pieces of Watermelon for 12 days and fetched a good price and zero wastage. He is very happy that after having this Sabji Cooler, people / customers are coming to his home to purchase, rather than he going to a market for selling the produce. He also kept Mangos for few days & got good price with zero wastage. He got Rs. 35000 by selling all 60 water melons which varies between 2-5 kg, which were cultivated in 1.5 acre. He is now encouraged to go for more vegetable production & sell at a good price.

Conclusion

T Omkar Vinay Kumar, Development Coordinator and Rabindra Behera, Development Associate of Resilience Project, Odisha from **MS Swaminthan Foundation** visited Banki, Baiganbud and Babuchhipidihi village of Babuchhipidihi G.P Sundergarh where Sabji coolers are already established. Farmers shared their views on cost, support and impact of the technology. Previously they were harvesting their vegetables once in a week now they are able to harvest three times in a week and stored the vegetables in a cooling chamber every day. They had a contact with local traders of Jharsuguda, when the rate is high that day they are going to market and sale their produces and getting right and better price from previous sale. At least 30 % extra cost they are getting by selling their produce. After storage in cooling chamber minimum 4 to 5 days the produce is safe and loss of damage is very less. This technology is very useful to farmers and definitely it is beneficial to the small and marginal farmers.



New method of storage is affordable

RuKart (a startup which is getting incubation support by IIT Mumbai) has been developing and promoting innovative agriculture technologies, which are affordable, recurring-cost free & scalable, for the marginal farmers market. RuKart, model focuses on local entrepreneurship promotion by engaging with local women self-help groups for the dissemination, repair and maintenance of technologies; so that these technologies are affordable, accessible by small and marginal farmers and provide them a dignified and sustained life and livelihood.

Success Story

Tale of a Tribal Farmer: Vegetable Farming

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Purandar Pidikaka - Green College Student in his field with peer farmers

A Case Study on Adoption Behaviour of a Tribal Veggie-farmer

Purandar Pidikaka lives in a village named Dhobagudi at Bissam cuttack Block of Rayagada district of Orissa. Dhobagudi is a village of Kondhs, one of the tribes in Odisha. The farming in Dhobagudi as well as in Rayagada depends on rain. Due to unavailability of Job source from Agriculture, many rural youths and farmers were migrated to other states for searching their work. Living Farms Green College has implemented a project on improving Livelihood through Green College Concept in Rayagada Dist. with support from GIZ, WHH and Tata Trusts.

Purandar has 600 square feet of area in his home stead which he used to grow a few varieties of vegetables only in rainy season .He has a wife and two children. In winter and summer months the family used to buy vegetables from the market once in a week. The meager earning of Rs 30 /- as daily wage prevented them from buying vegetables regularly. The one drumstick plant in the homestead has been the only source of some form of greens for the family.

He along with three other farmers from his village had volunteered to be trial farmers to evolve solutions to be able to grow vegetables for at least eight months in a year from the present three months for household consumption. He had cited the lack of water, seeds and fence as underlying reasons for not being able to grow vegetables in rest of the months of the year.

Living Farms Green College team has facilitated the first phase of thirty days training on commercial vegetable garden in March 07, 2017 in the project villages. The emphasis was given on varieties of such vegetables and fruits for cultivation in a nutrition garden which are traditional, can tolerate water stress, germinate easily, require less care, whose crop might be harvested over a longer period of time and seeds can be conserved for next season. The participants were also trained on improving soil fertility and disease & pest management techniques to reduce their dependence on market for inputs.

The villagers learned during the Green College training programme:

- To make vermicompost
- To make liquid Manure
- To plant circle garden
- To make compost pit

Purandar made his own compost pit and pots of liquid manure to improve microbial activity in soil and botanical pesticide to control pests. He built 3 raised beds with an east ~ west direction of 100 square feet each and three circle gardens of 1 meter diameter. He along with others were provided with vegetable seeds by Living Farms Green College collected from farmers. He has grown brinjal, bullet chilly, pumpkin, ridge gourd, cow pea, ivy gourd and cluster beans etc. in kharif / rainy season. He has also planted five papaya saplings in his home stead. A grown papaya plant yields fruits for 4 years at a stretch.

Thus the variety of vegetables grown in his nutrition garden increased from three – brinjal, ivy gourd and chilly to seven the rainy season & in summer Pumpkin, tomato. Unlike previous years he has conserved seeds of these vegetables. In August the second phase of training was facilitated with an objective to learn from the experience of the rainy season and plan for the winter season.

He found liquid manure to be very useful and easy to prepare without any expenses. So, he decided to prepare this in a cycle of five earthen pots of 20 liters each once in every 10 days for the winter vegetable crops. The four farmers of this village had prepared a common nursery in the fourth week of September to grow seedlings of tomato, chilly and brinjal saplings.

He planted two varieties of chilly, brinjal, tomato, marigold flowers and basil alongside the vegetable beds .He has grown other vegetables green peas, French beans, okra, spinach, coriander, cow pea and bunching onion etc. in the inner space of the beds. Marigold and basil play an important role as pest repellent.

He was helped to document the amount of his money, time, value of farm yard manure, water invested and crop loss due to disease & pest attack per 100 square feet of bed and the net output in terms of vegetable yield, income earned out of selling, amount consumed at house hold level / values, amount of vegetables shared with others and seeds harvested.

He is very happy to see his garden having vegetables grown even during winter and his family had vegetables almost every day from November to Mid February. He has shared his experience along with his calculation of input & output with other farmers from his village. The farmers have requested him to share his seeds with them as well as help them to learn the nutrition gardening.

Purandar has also begun working to raise a productive live fence around his garden. The live fence has multipurpose bush, shrubs, climbers seasonal, annual and semi perennial plants etc. The live fence once grown provides fruits, vegetables, biomass for compost as well as security of the nutrition garden.

This project has intensively worked with 38 farmers on the trade of Vegetable Farming. However, at the end of the year there were 96 farmers involved in nutrition gardening and sharing seeds amongst themselves. There were at least seventy farmers who were growing vegetables regularly for eight months in a year even in 2018. The process is farmer led.

Financing Agriculture: Types of Loans & Opportunities

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Minting Money through Agriculture

Agriculture is the dominant activity in India. As per India Economic Survey data 2018, it employed more than 50% of work force and contributed 17-18% to country's GDP. It is one of the priority areas of Government of India. To improve flow of credit to this sector, nationalization of banks took place in the years 1969 and 1980. Government of India felt the need to channelize resources to agriculture sector by fixing mandatory level of financing by banks. To increase flow of resources to the sector, green revolution, white revolution, yellow revolution and gene revolution implemented in the country. Because of the above revolutions, the need for more resources to agriculture sector improved. The farmers approached banks for loans for acquiring productive assets, high yielding varieties, fertilizers, pesticides etc. To cater to the needs of farmers, NABARD came into existence in the year 1982 to look after flow of resources to agriculture sector. Gradually, the loans disbursed by financial institutions like banks increased. These loans are under various categories like crop loans and other short term loans, investment loans, development loans etc. Similarly, in the year 2015, the entire food processing sector is brought under Agriculture which was part of MSME previously.

Agriculture loans are classified as short term, medium term and long term loans depending upon the repayment period and type of activity.

Under short term loans, the most important loan is "Kissan Credit Card" (KCC) which started in the year 1998. It is provided to farmers throughout the country. It can be given for raising all types of crops (Cereal, Oil seed, Pulses, Vegetables, Fruits etc) and allied activities in the form of revolving credit. It is just like a cash credit limit to traders and manufacturing units. The entire requirement of funds for all crops grown in one year along with other requirements under consumption, non-farm sector, maintenance and repair of farm assets are considered in the limit. No need for submission of bills and receipts. ATM cards and cheque books can be used for withdrawal of the amount. It is in the form of revolving credit. Similarly, for allied activities like poultry, dairy, fishery etc loan can be granted under OCC limit.

Under medium term loans, mostly the movable assets like tractor, trolley, vehicle, combine harvesters, pumpsets, solar pumpsets, milch animals etc are financed. Here the repayment is made in installments during the economic life of the asset.

Under long term loans, generally development made on land is financed. The examples are land leveling, fencing, construction of farm house, storage structures, minor irrigation loans, drip and sprinkler irrigation assets, reclamation of land. The repayment period can go up to 9-20 years.

Farmers can approach any bank of their choice nearer to their place of residence or farm for availing loans. In case of KCC, they should go with copy of land records, fulfill the terms and conditions for availing loan. In case of creation of movable assets out of loan proceeds and development on land, farmers can approach bank with required documents along with copy of quotation of the asset/ estimate for development work. Farmers can either avail only short term loan like KCC/ term loans for acquiring assets or composite loans. In some cases where the gestation period is more and with larger repayment period, project report is to be submitted along with the proposal.

FINANCIAL ASSISTANCES

Subsidies are available from various agencies as capital assistance and interest subvention for agriculture loans from Central and State Governments. Some of the important schemes are furnished as under:

FARM SECTOR

- Interest subvention of 2% is available to KCC loans for raising crops. In addition to this, another 3% interest subvention is provided for prompt repayment for loans up to Rs 3 lakhs.
- DEDS scheme of NABARD, capital subsidy for Dairy Projects.
- Commercial production units under organic/ biological inputs from NABARD
- AC & ABC (Agri Clinic and Agri-Business Centres) from NABARD
- National Live stock Mission for Poultry, Pig, Rabbit development etc from NABARD
- Agriculture Marketing Infrastructure scheme for capital subsidy in eligible storage and marketing infrastructure operated through NABARD.

NON FARM SECTOR

- Credit Linked Capital Subsidy Scheme (CLCSS) for Technology Upgradation of Micro and Small Enterprises

In addition to the above, various state governments extend capital subsidy, interest subsidy on acquisition of Farm Machineries, Equipments, Allied Activity projects which can be enquired from the Agriculture Department of respective states.

Verifying Viral Virus Truth in Tomato

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Virus diseases are serious threat in profitable tomato cultivation, and virtually in absence of any antiviral products, management strategies rely chiefly on genetic resistance, essentially on hygienic practices to prevent virus spread; or on eradication of diseased crops. Ever-increasing international travel and trade of seeds and fruits have enhanced the risk manifold. Coupled with the changing climate, consequent spread of newly introduced viruses and/or the associated sap sucking insect-vectors in relevant areas are potential threats. Tomato is economically the most important vegetable crop globally, and more than hundred of viruses infect and harbour in tomato crop, while new virus diseases keep emerging. This article deals with the latest controversy on „Tiranga“ virus, allegedly invading vast tomato belt in Maharashtra, in past months.

The ongoing corona pandemic has pushed 26.5 crore people to hunger. Around three fourth of the workforce in informal sector has been severely affected worldwide. Back home, India is lagging behind in meeting nine of seventeen Sustainable Development Goals (SDGs). Zero-hunger is amongst one such SDG. Adding to pandemic problem, the near plague like situation, trans-boundary locust invasion from western nations into India has endangered many states – Rajasthan, Gujarat, MP, Maharashtra, UP and even predicted invasion in far-flung states like Bihar and Odisha by FAO, in coming months. Already, *Amphan* cyclone took its toll in WB and Odisha in May, cyclone *Nisarga* in early June that slammed Maharashtra coast (fortunately had diminished disastrous impact) – all problems one after another are presenting a cumbersome gloom scenario in Indian context.

Science, that played the pivotal role in transforming societies, raising standards of life and enhancing human capabilities since time immemorial is being confronted with major challenges ranging from climate change to severe environmental degradation, water scarcity, threatened biodiversity, losses in life and wellbeing due to pollution, human diseases like corona pandemic, plant viruses, and other disasters like cyclone and locust invasion. Moreover, an increasing demand for food, feed and fibre by an ever-teeming population makes the condition even more complex in agri-sector. Herein, we deliberate on the tomato virus in Maharashtra in past months that has created hue and cry countrywide. In absence of any anti-viral agent, prevention is the only option left with us.

Vulnerable victims

Every year, our country drains 740 billion crore rupees on account of a vast array of disasters, as its 58.6% land area are prone to earthquake and 8.5% vulnerable to cyclone. Right now, entire world so also India is under the clutch of corona pandemic. The international pest locust invasion is nearing the plague status. In such situation, second fortnight of April to mid May 2020, Maharashtra witnessed media buzzing on a mysterious virus invading tomato (*The Hindu Businessline, Zee News, Indian Express, Times of India, Horti-daily, TV9 Bharatvarsh, News24online etc*); regrettably few even resorted to correlate this tomato „Tiranga“ virus to dreaded corona, causing much panic amid public; though the fake claim was later rectified by the relevant TV channel (thanks to timely intervention of Horticulture Commissioner Dr BNS Murthy, DAC & FW, GoI). Rumor-mongers knew no bounds, and this risky phenomenon is quite common in our

society. Being a potential problem, this has gained further grave proportion, due to recent digital revolution, wide spread circulation via social media, and even by the print. To increase TRP, media may often resort to such unscrupulous, sensitizing scary news capsules, citing catchy punch lines on the public domain, and this made the maximum harm to public, poor farmers and customers under the ongoing nationwide shut down. This is only adding to the sudden economic slump of our state affairs.

In such a sordid situation, the real victims are the poor farmers, the poor public getting panicked, as mind-boggling fake news capsules like the ill-claimed correlation to corona virus. Host-switching to human or higher animals is yet to be reported in plant virus. Whilst media, could gain its much coveted TRP, rumor-mills got their pie working full time, disturbing the socio-economic harmony, causing collateral loss to the country's vegetable basket Maharashtra. A clarification, on scientific scrutiny is thus solicited in any enlightened society.

People, profession and profit

Maharashtra farmers grow summer tomato in February, a favorite, of which the first harvested commodity commences late April, and continues to cater the market demand till July. This year, early ripening and substantial yield loss was complained by farmers, endorsed by state agri-professionals. In irrigated belt of Pune, Satara, Ahmednagar and Nashik, this problem had propped up, and the hyperactive media house (both social and print) made it more viral. Rabi or summer tomato crop is the most preferred crop in these irrigated areas, often dominated by tomato hybrids (>90%) that meet export demands (like Bangladesh and Dubai), by the farmers, realizing maximum profit, filling the pockets of peasants. A farmer from Phalton tehsil (Satara district) first blew the whistle, reporting more than 90% fruit loss. Tomatoes were turned yellow, abnormally and farmers were forced to dump fruits *en mass*. As reported, the victim farmer sprayed fungicide, but in vain. The report alleged no abnormality in the crop's previous pheno-phase, but recorded problem in fruiting stage. Shortly, the digital savvy public via the versatile social media, and print both, blew the problem out of proportion. Even, one reputed national TV channel correlated this to corona. The virus is nicknamed as „Tiranga“, alleged 50-60% crop loss, farmers complained of irregular shapes and color, premature ripening and distortion. Some seed companies analyzed the samples, allegedly reported no significant viral infection. The locale state agriculture university (MPKV-Mahatma Phule Krishi Vishwavidyalaya, Rahuri) surveyed certain affected areas, collected samples, sent to ICAR-IIHR, Bengaluru for detection of the cause, in first half of May 2020.

Tomato is an important vegetable crop in India after potato, second rank holder in world producing around 20,000 million tones/annum (but one third of production in China). No doubt, rumours such as „Tiranga“ virus has inflicted irreparable loss to our farmers in Maharashtra. The typical „Tiranga“ nomenclature is originated from the fact that, the infected tomato fruits presents typical three colors – red/brown, green, white and yellow in patches. Farmers termed it so, as they alleged that the entire tomato crop would turn into stripes of red, yellow and green. Officially it has no acceptance scientifically, an unfounded claim, of course.

The complaints of tomato crops getting devastated by the mysterious virus started pouring in from late April but the Covid-19 lockdown has prevented scientists from survey and identifying it, and determining the causal organism(s). Apropos *The Print* (23-May 2020) an anonymous scientist (Indian Institute of Vegetable Research, Varanasi), opined that the major tomato producing states such as Andhra Pradesh, Madhya Pradesh, Karnataka and Gujarat border Maharashtra where the outbreak of this mysterious virus has/may occur, ought to find the cause and cure for the virus, preventing the its spill-over to the neighboring states. The scientist, however, said the virus cannot harm the human body as the receptors required for the entry of viruses into human cells are completely different from those of plants. A decade-old research article [*Indian Journal of Virology*, 2010; **21**(1)], from the Advanced Plant Virology Centre (APVC) of ICAR – IARI, New Delhi; points that plant virus cannot cross-infect human beings and animals.

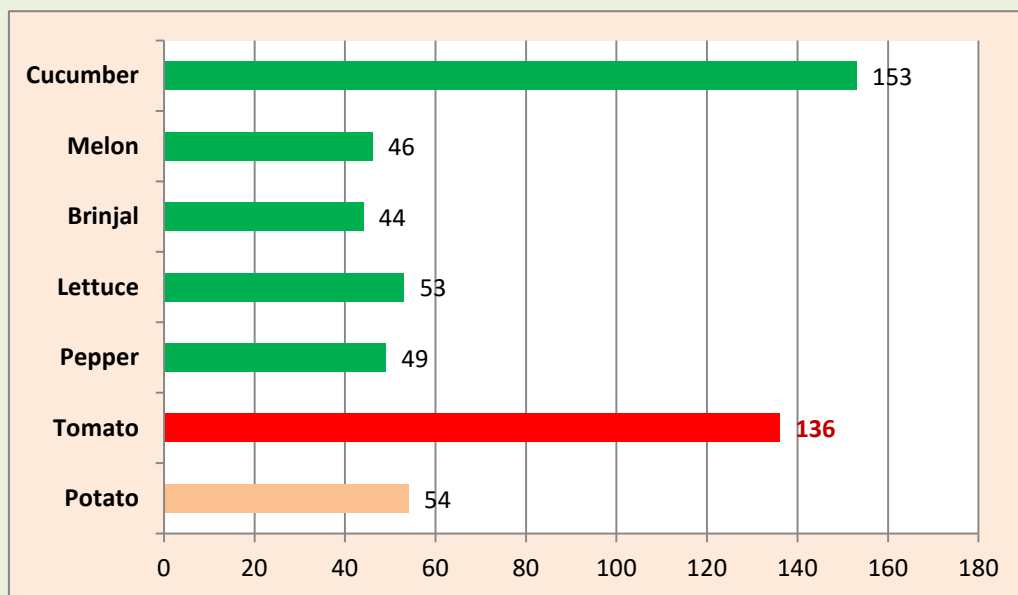
Our station being the seat of plant virology, took this task to make the public aware of the situation, scientifically. Fortnight prior our testing, ICAR-Indian Institute of Horticultural Research, Bengaluru released (? , available in social media) the test report of virus affected tomato samples from Maharashtra. Our test report, is compared comprehensively, and compiled a brief note consequently, to suffice an understanding of the situation, and also its possible implications, future prospects in Indian context, for the larger benefit of farming fraternity.

Virus prevention – the only option

Once infested, there is no cure for virus diseases. Prevention is the best policy than cure. Following few points are to be pondered in planning a Good Virus Management Practice (GVMP).

Why viruses target Tomato more

With global production of 130 million metric tons, worthy over 30 billion international dollars in 2007, tomato is by far the most important vegetable crop (source: FAO). Tomato constitutes 72% of the value of fresh vegetables produced worldwide. The number of described viral species that infect tomato crops amounts to 136, whereas this number is notably lower for other vegetable crops (Brunt *et al.* 1996).



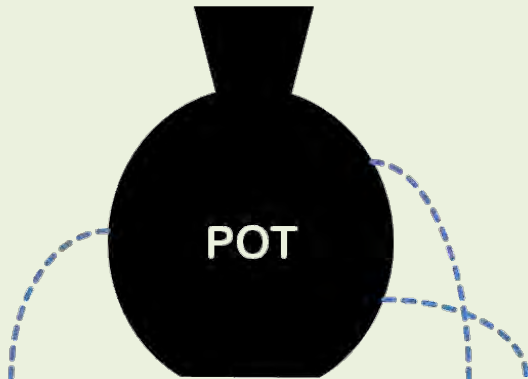
Viruses invading the veggies worldwide (total number)



So many viruses in tomato may partly be explained by

- Sensitivity of this crop to members of the genus *Begomovirus*, which harbors a large variety of species.
- Intensive breeding for improved production might have narrowed the genetic base for virus disease resistance in commercially grown tomato cultivars.
- Crop-intensification with large areas of protected mono-cropping under controlled climate conditions may generate conducive conditions for efficient spread and survival of viruses and their vectors, making virus more virulent and vectors endemic.
- Prime economic importance of tomato makes the investigation on pathogens and pests a major thrust arena, consequently, more pathogens are characterized and reported.

In India, **POT (potato, onion and tomato)** has always dominated the common marketplace for vegetables, but victimized time and again. These three veggies enjoy inevitable place in our platter. The vegetable cultivation and market is risky and seems as if gambling with time, space and climate. The **POT** is often with holes one or the other way. Potato petrifies, onion tears and tomato torments/tortures the farmers, and the public (consumers) badly. And this time the story is in **Tomato**.



POT (Potato, Onion, Tomato) – our essential veggie basket

Cryptic and complex of viruses and insect-vectors – syndrome study essential

IARI Regional Station, Pune; received few samples of virus infested tomato (varieties - Abhinav, Ansul and Ansul-83; from hybrid seed companies Syngenta, Seminis & Clause, respectively). Samples were from the farmers of Kolwadi and Alandi area of Pune District, as provided by Taluka Agriculture Officer, Haveli, Pune (21-05-20). The samples were tested for seven viruses *viz.* Cucumber Mosaic Virus (CMV), Groundnut Bud Necrosis Virus (GBNV), Tobacco Mosaic Virus (TMV), Tomato Mosaic Virus (ToMV), Tobacco Streak Virus (TSV), Pepper Mottle Virus (PMoV) and Potato Virus Y (PVY). Virus tests were done by ELISA (for all) and by PCR for four (CMV, GBNV, TMV and TSV). Results showed positive for five viruses *viz.*, CMV, GBNV, ToMV, PMoV, and PVY.

Virulent viruses

Over recent years, several virus diseases, including *Tomato yellow leaf curl virus* (TYLCV; genus *Begomovirus*), *Pepino mosaic virus* (PepMV; genus *Potexvirus*), and have emerged in greenhouse and open cultivated tomato crops and are presently impacting fresh-market tomato production in diverse geographic areas worldwide. TYLCV affects tomato cultivation in several countries in the world is known to reduce the lifespan and fecundity of its insect-vector, *Bemisia tabaci*, and the virus is transmitted trans-ovarian (passing next generation through eggs). Viruses may undergo alteration to inhabit in a newly introduced niche. Two strains (New Delhi and Bangalore) exist in case of TYLCV causing leaf curling in tomato.

Tomato brown rugose fruit virus (ToBRFV) though not detected in test-samples, it is to be emphasized that, samplings were done inadequately, a careful planned survey and surveillance is the need of this situation. Already, this dreaded virus was reported recently in Asia (China, in April 2019), Mexico (in September 2018), England (in 2019-20). (EPPO - European and Mediterranean Plant Protection Organization global database). ToBRFV was first described from tomato crops in Israel in 2014, where the virus spread in tomato greenhouses almost nationwide within a period of one year. The virus has since been reported from Jordan, Mexico, and Italy, including the island of Sicily, and is prevalent in many poly/glass-houses, but under eradication in Germany. The virus is a tobamovirus, and is related to TMV and ToMV. However, the new virus can overcome the Tm-2² resistance gene, therefore TMV and ToMV resistant varieties are susceptible to this virus. At present there is no reported tomato resistance to ToBRFV. India is yet to report this virus in its land.

Threesome troublemaker insect-vectors

Sap sucking insects aphids, whiteflies and thrips are the culprits in spreading many virulent viruses to target crop. The cultivation practice is continually changing in India, particularly more in Maharashtra, with more acreage going to protected (polyhouse) cultivation, intensified frequent insecticidal treatments, often unilateral and injudicious pesticide utilization as advised by locale pesticide dealers and agro-consultants (vicious contract between the two). The international trade and travel has compounded the vector problem, with new species, strains/biotypes/genomic groups emerging in the arena.

Author himself, surveyed personally the Pune, Junnar and Nashik areas, and witnessed few solanaceous crop fields showing seasonal replacement of *Bemisia tabaci* with a different, somewhat smaller whitefly. Scientists of our station, reported emerging threat of such a new begomovirus vector, *Solanum* whitefly *Aleurothrixus trachoides* (Back) in solanaceous veggies (tomato, potato and bell pepper) that was considered a non-virus vector by European and Mediterranean Plant Protection Organization (EPPO) reports (*Journal of Biosciences*, **45**(1): 2020). Good news, a doctorate student, guided by scientist of Pune station, confirmed, in captivity study of common whitefly *Bemisia tabaci*, the substantial susceptibility of imidacloprid resistant whitefly to cyantraniliprole, and possibility of using this in insecticide resistance management strategy (IRM)(*Annual Report 2018-19*, ICAR - IARI, New Delhi).

Similarly, other two vectors aphids and thrips, are most probably changing their pestilence status, species-spectrum and vector-virus interrelationships. *Thrips palmi* – prevalent in onion belt of Nashik and Pune, may be getting more active in tomato crop. An in-depth investigation in detail, into all these aspects is need of the hour.

Good Agricultural Practices (GAP) for virus management in Tomato

(This part is published in *Down to Earth*, 13-June 2020, online)

Seed source

- Procure quality seeds from reputed sources, adopt resistant/tolerant varieties if available.
- Procure good quality seedlings grown in insect-proof net nursery, from reputed vendors only.
- Seed treatment
 - Treat with 0.3% trisodium phosphate for 48-hr, wash properly, shade-dry, followed by suitable fungicidal treatment
 - Exposing dry seeds to high temperature (70⁰C) for 2-4 days, 10% trisodium phosphate (minimum 15-min) is alternatively suggested also.
 - Skim milk wash can be used also as treatment (to be validated scientifically).

Nursery

- Nursery bed, raised 15cm high, soil treated with Thimet* 25g/3 sqm bed, admixed with sand or soil for ease in delivery (*to be banned w.e.f. Dec 2020).
- Use Insect-proof net (40-60 mesh).
- Remove of the symptomatic plants whenever possible to slow the virus spread.
- Use balanced fertilisers and manures.
- Use label claimed and registered products only.
- Prior-transplanting, seedlings are to be treated with 0.25 - 0.5 ml/L imidacloprid (17.8%SL) solution.

Main field management

- Adopt floating row cover if feasible, particularly in insect vector prone areas (aphids, whiteflies, thrips).
- Use silver mulch, to conserve moisture and insect-vector distraction.
- Install yellow and blue sticky traps for aphids and fleas.
- Few diseases spread via contacts (root and foliage), so spatial distancing avoiding physical contacts is suggested.
- Weeding of alternate hosts, in and around the field is advocated as they often harbor the insect-vectors, and act as virus reservoir in off-season.
- Follow alternate application of neem-oil (0.2%), and imidacloprid (0.5ml/L 17.8%SL) till flowering, at 10-12 days interval. Follow the label claims.
- Avoid cross-infection from tobacco field or production system, essentially.
- Dispose of duly, the infested tomatoes; never throw them here and there.
- Soon, after harvesting, destroy the old standing crop, as that carries the virus carry-over inoculum.
- If insect-vectors like whiteflies are still surviving in old harvested crop stand, treat them with an appropriate toxic insecticide, to prevent their spread to newer crop/neighborhood areas.
- Take proper care in post harvest stage, careful washing of equipments, storage bins, and avoiding physical contacts, are advocated.
- Farm labors should not enter the storage unnecessarily, without washing their exposed body parts, use aprons and gloves - proper hygiene is a must.

Conclusion - potential problems looming ahead

Despite begging a pride place in adopting United Nations Sustainable Development Goals, with score 64/100 by Niti Ayog (Kerala, first 70/100), still Maharashtra faced this problem, it is left now, for state government agencies how to tackle such situations in near future, seeking cooperation from all stakeholders inclusive central government agencies in time. Vigilant inspection and strict regulation are needed to counteract the outlawed aggressive marketing strategies adopted by pesticide houses, if so. Awareness campaigns are to be taken care of.

Calling upon a concerted effort in consortium mode, we suggest setting up of suitable survey and surveillance teams (*survey is one time, surveillance is periodic study at intervals*). Appropriate funding in mega-project mode, to scientists (entomologists & virologists) stationed at Maharashtra state, is suggested to bridge the research gap, in order to come out with much needed Good Virus Management Practices (GVMP) for the affected areas. In this current International Year of Plant Health 2020, let us strive for proper plant hygiene in all crops, not only tomato. Botanicals and bio-pesticides should be given due priority in insect-vector management. Plant growth regulators, hormones etc are only improve plant immunity, but not panacea to viruses.

The critical points singled out, is the vicious contract between plant protection consultants for vegetable farmers of Maharashtra with pesticide houses. Quite often they advocate unnecessary pesticides like

fungicides and plant growth regulators/tonics, for even virus diseases. Though they know very well, no anti-viral agent does exist for viruses, the much aggressive marketing strategy by pesticide houses, enforces such situations in field. A glimpse of the Table-1, implies how the farmers are exploited by getting advisories for using fungicides and other products, unnecessarily for viruses. The confession of the whistle blower farmer for „Tiranga“ virus, in terms of application of fungicides, is itself the glaring example. We should be prepared to adopt the GVMP in tomato cultivation. Thanks to CSE, that has campaigned successfully, to phase out the TB-drugs like streptomycin and tetracycline (to be banned by end 2022), the rampant misuse of such other antibiotics and even label claimed fungicides, strictly must not be used in tomato virus management, as they are not intended for viruses. Label claim must be not only on **pesticide-to-crop** basis, but ought to be on **pesticide-pest/disease-crop** basis.

Whilst, extreme weather tops the risk, four new states joined the list of farmers committing suicide, massive migration nationwide (5.5 million during ongoing pandemic, merely by shramik trains), grave ground water pollution and our compromised green growth – all lucidly stated in the *State of India's Environment 2020 In Figures* (CSE, June 2020); this „Tiranga“ virus problem is mostly a misplaced propaganda/rumour. Nevertheless, the hard fact underlies, due to complex climatic changes, enhanced insect-vector scenario, increased international travel and trade, widespread cultivation of exported tomato seed lots (may be from virus prone nations) by private seed companies, changed cultivation scenario dominated by hybrids, increased frequency and intensified of agri-inputs (even cocktail pesticides), lopsided agri-sector growth, changed plant-insect-virus tritrophic interaction, often coupled with triggered actions by temperature and erratic monsoon (climate), and at last but not least, the cryptic virus complex throw a tough challenge for all. We conclude, thus *Virus control is a race against time, space and climate*.

Table 1.
Label claimed pesticides, suggested for application in GAP (Good Agricultural Practices)

Label claimed pesticides (vide The Gazette of India, No. 537, 24-Dec 2018, for these pesticides MRL values are given in the gazette)
A – Alpha naphthyl acetic acid, Ametroctradin, Azoxystrobin
C – Chlorantraniliprole, Cyantraniliprole, Cyazofamid, Cymoxanil
D – Difenoconazole, Dimethomorph
E - Ethephon
F – Fenamidone, Fenazaquin, Flubendiamide
I – Imidacloprid, Indoxacarb (for Lepidoptera only), Iprodione
K - Kasugamycin (antibiotic)
L – Lambda- cyhalothrin
M – Metiram, Metribuzin, Metalaxy-M
N – Novaluron
P – Phorate*, Propineb, Pyraclostrobin
S – Spiromesifen, Sodium para nitro phenolate
T – Tebuconazole, *Tetracycline (antibiotic), Thiamethoxam, Trifloxystrobin
(Trisodium phosphate is not a pesticide, but food additive, inhibits virus when applied to seeds and seedlings, @ 10% for at least 15 min)

Please note, **none is anti-viral agent**. Farmers are often fooled by pesticide dealers.

*To be banned by the end of Dec 2020.

Blue – Fungicide,

Green – Plant growth regulator/Hormone

Red – Insecticide and/or acaricide/miticide,

Black – Herbicide

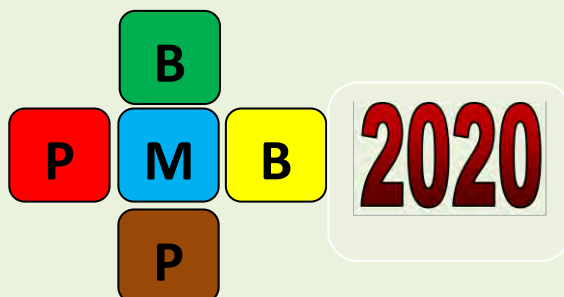
Proposed Pesticide Ban and its Impact on Vegetables

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PMB – Pesticide Management Bill (2020) is pending approval from Rajya Sabha.

BMP – Best Management Practices, whether we would manage to attain in agriculture and allied sectors, is the million dollar question, in our mind.



It is reported that, proposed ban comprises around 20-25% of domestic market, a huge 43000 crore INR. The ongoing covid impacted agrochemicals to the tune of 3.4 billion US\$, in India. Indian agrochemicals is valued at 42000 crores (ca. 6 billion US\$). In a webinar (11-06-20), Dr S K Malhotra, said that lots of initiatives were taken even during covid lockdown, the codex MRL values were extended/will be extended, in absence of such data, in pesticides, facilitating the pesticide industry. Crop grouping for label claims are also being considered to widen the sphere for successful pesticide business. Such government supports are most welcome and pesticide industries are invited to work for the safer chemicals, *albeit* suffering some market, but in short-run.



From: *Paracelsus, Philosophia Magna*
Birckmann, Cologne, 1567 AD

“Nothing is poisonous and everything is poisonous; the dose determines the poison.”

Reasons for draft ban

- End of releases and related environmental health hazards and environment-economics.
- Economically available alternatives for most crops for associated pest-complex are available, and if not, can be searched, only time matters. So critical use pesticides may give some reasonable time limits for phase out stepwise, not at once.
- Safer chemical alternatives are to be searched at any cost. Our aim towards, Fit India, Hit India, must be strengthened through residue free food, feed and fibre.
- A new thing is always opposed by orthodox, and we ought to confess that once we thought that when DDT, BHC, Aldrin, Chlordane, Heptachlor, Endosulfan etc were banned/ restricted, all apprehended that we will face certain hardship. But today we stand tall, without those dirty dreaded synthetics, and that is the essence of change, for a greener earth, a safe place to present our future generation. Since, her historic writing of classic *Silent Spring* (1962, Rachel Carson), the pesticide industry had opposed such changes always, against drastic and revolutionary paradigm shifts, but slowly kept pace in course of time, and we assume and earnestly hope, same thing will repeat again, in current crisis, arisen due to proposed ban of 27 pesticides. Only thing to deplore, in one go, so many changes, coping is a tough challenge for corporate house in concerned sector, and more so for our farming fraternity, where a clear-cut alternative options are still not pronounced, though one month over of the draft order (14-05-2020). It is learnt, of course, the 45-days draft ban period is extendable, most likely to 3-months. As founder of a *Vegetable Farmers Forum* (Smart AgriPost, May-2020, pp.20-24), and otherwise in various social media and fora, we received umpteen queries, apprehension on availability and possible impacts on proposed banned pesticides. Certainly, it has created amid farmers, confusion on these crop-protection issues.

Harmful effects of pesticides has always been a debatable issue for discussion especially after Rachel Carson's classic *Silent Spring* in 1962. That was a starting point for mankind to realize the dark side of the pesticides, which lead to greater realization that pesticides can be a double edged sword, i.e. pesticides if not used judiciously they kill not only targeted-pests/diseases, but also harm non target-organisms, destroy biodiversity and pollute nature on an unprecedented scale. In this scenario most of damage was used to be caused by the conventional synthetic pesticides, which are usually older non-selective broad spectrum killing agents. Every country used to ban, withdraw or phase out poisonous pesticides after certain years of usage with reasons. Till date India has banned 40 pesticides and withdrawn 8 among all 355 total deliberated pesticides. Moreover recently Govt. of India has proposed ban of 27 pesticides for import, manufacture, sale, transport, distribution and use under Draft Order called Banning of Insecticides Order, 2020. This sparked a great deal of discussions and arguments among different stakeholders, arguments for both for and against. Arguments such as reduced export revenue, increase in cost of control intervention, loss of jobs in manufacturing sector and future food security etc. are raised.

These 27 pesticides in the proposed ban includes 11 insecticides, 1 miticide, 8 fungicides and 7 herbicides and on deeper inspection it is understandable that most of the pesticides in proposed list i.e., 63% are registered before 1972, and are serving for past five-decades or so, i.e., but are popular and cheap. They can be allowed to continue just like that or be banned with valid reasons is the issue. It is need of the hour to ban or phase out older obsolete molecules, poisonous pesticides (but with scientific reasons) to promote safer and greener tomorrow. But only banning of few old pesticides molecules will not solve our problems, for that a more scientific and judicious approach is needed. Because, in this situation of population explosion we have more mouths to feed. In our run for higher agricultural productivity, pesticides do have a great role to play, which no one can ignore nor hide. So judicious use of pesticides is recommended and safer and greener molecules need to be promoted. It is always normal for raising good arguments and healthy discussions at this phase, as new ideas are always opposed by orthodox. We need to remember that in the past, when DDT, BHC, aldrin, chlordane, endosulfan, etc. were banned/restricted we expected to face extreme hardships but today we stand tall without those dirty dreaded molecules. Thus we need to understand nothing is permanent except change and one should be able to adapt to changing environment and find new opportunities in that change to grow further. In vegetables, the residue problem is still of grave consequences, and available alternate options for proposed banned pesticides are deliberated in the paper. Suitable measures should be taken to increase the stakeholder's awareness, scientific usage of label claimed pesticides with right delivery system.

Alternatives for banned pesticides (Banning of Insecticides Order, 2020) in Vegetables

Crop	Pest	Insecticide Banned usage in agriculture	Alternatives/Insecticide still recommended in agriculture
Potato	Aphids <i>Myzus persicae</i> , <i>Aphis gossypii</i>	Carbofuran	Oxydemeton methyl, Phorate*, Thiamethoxam
	Jassids <i>Empoasca kerri</i>	Carbofuran	No recommended alternative in MUP#
	Thrips <i>Thrips sp.</i>	Dimethoate	No recommended alternative in MUP
Onion	Thrips <i>Thrips tabaci</i>	Dimethoate	Lambda-cyhalothrin, Fipronil, Oxydemeton methyl
	Root grub	Chlorpyrifos	No recommended alternative in MUP
Tomato	Fruit borer <i>Helicoverpa armigera</i>	Methomyl, Quinalphos	Azadiractin, <i>Bacillus thuringiensis var. galleriae</i> , Chlorantraniliprole, Cyantraniliprole, <i>H.a</i> NPV, Indoxacarb, Lambda-cyhalothrin, Novaluron, Phosalon
	Whitefly <i>Bemisia tabaci</i>	Carbofuran, Malathion	Azadiractin, Cyantraniliprole, Imidacloprid, Oxydemeton methyl, Phorate*, Spiromecifen, Thiamethoxam, <i>Verticillium lecani</i>
Brinjal	Shoot & Fruit borer <i>Leucinodes orbonalis</i>	Chlorpyrifos, Deltamethrin, Thiodicarb	Azadiractin, Chlorantraniliprole, Cypermethrin, Emamectin benzoate, Fenpropathrin, Fenvalarate, Lambda-cyhalothrin, Spinosad, Thiodicarb, , Trichlorfon*
	Mites	Malathion	Fenpropathrin, Flumite
	Yellow mite <i>Polyphagotarsonemus latus</i>	Dicofol	Fenpropathrin, Flumite
	Rootknot nematode <i>Meloidogyne sp.</i>	Carbofuran	<i>Paecilomyces lilacinus</i>
	Reniform nematode	Carbofuran	No recommended alternative in MUP
Okra (Bhindi)	Shoot and fruit borer <i>Earias vitella</i>	Deltamethrin	Emamectin benzoate, Fenpropathrin, Fenvalarate, Pyrdalyl
	Fruit borer <i>Helicoverpa armigera</i>	Quinalphos	Azadiractin, <i>Bacillus thuringiensis var. galleriae</i> , <i>Beauveria bassiana</i> , Chlorantraniliprole, Cypermethrin, Lambda-cyhalothrin,
	Jassids: <i>Amrasca biguttula biguttula</i>	Carbofuran, Malathion	Azadiractin, Buprofezin, Cypermethrin, Fenvalarate, Flupyradifurone, Imidacloprid, Lambda-cyhalothrin, Oxydemeton methyl, Thiamethoxam, Tolfenpyrad
	Aphids: <i>Aphis gossypii</i>	Malathion	Acetamiprid, Azadiractin, Imidacloprid, Thiamethoxam, Tolfenpyrad
	Red spider mite: <i>Tetranychus spp.</i>	Dicofol	Fenazaquin, Spiromecifen
	Mites	Quinalphos	Fenpropathrin

Chilli	Fruit borer <i>Helicoverpa armigera</i>	Deltamethrin, Thiodicarb	<i>Bacillus thuringiensis var. galleriae</i> , Chlorantraniliprole, Cyantraniliprole, Emamectin benzoate, Fipronil, Flubendiamide, Indoxacarb, Lufenuron, Novaluron, Spinetoram, Spinosad
	Thrips <i>Scirtothrips dorsalis</i>	Carbofuran, Methomyl	Acetamiprid, Cyantraniliprole, Emamectin benzoate, Ethion, Fenpropathrin, Fipronil, Imidacloprid, Lambda-cyhalothrin, Oxydemeton methyl, Phorate*, Spinetoram, Spinosad, Spirotetramat, Thiacloprid, Thiamethoxam
	Aphids <i>Aphis gossypii</i> , <i>Myzus persicae</i>	Carbofuran, Quinalphos	Carbosulfan, Fipronil, Imidacloprid, Oxydemeton methyl, Phorate*, Pyriproxyfen, Spirotetramat
	Mites	Quinalphos	Chlorfenapyr, Cyenopyrafen, Diafenthiuron, Emamectin benzoate, Ethion, Fenpropathrin, Lambda- cyhalothrin, Oxydemeton methyl, Phorate*, Propargite
Cabbage	Diamond back moth <i>Plutella xylostella</i>	Chlorpyrifos, Thiodicarb	Azadiractin, <i>Bacillus thuringiensis var.</i> <i>galleriae</i> , <i>Bacillus thuringiensis var.</i> <i>kurstaki</i> , <i>Beauveria bassiana</i> , Chlorantraniliprole, chlorfenapyr, Chlorfluazuron, Cyantraniliprole, Cypermethrin, Diafenthiuron, Emamectin benzoate, Fipronil, Flubendiamide, Indoxacarb, Lufenuron, Meta fumizone, Novaluron, Pyridalil, Spinosad, Tolfenapyrad, Trichlorfon*
	Mustard aphid <i>Lipaphis erysimi</i>	Malathion	Acetamiprid, Azadiractin, Cyantraniliprole,
	Nematode	Carbofuran	No recommended alternative in MUP
Cauliflower	Head borer <i>Hellula undalis</i>	Malathion	No recommended alternative in MUP
	Stem borer	Quinalphos	No recommended alternative in MUP
Cucurbits	Various	NA	NA

*: Use of insecticide shall be completely banned w.e.f 31st Dec 2020

#MUP: Major Uses of Pesticides, Ministry of Agriculture & Farmers Welfare, Government of India (31-01-20)
(Compiled for information, not legal purpose, cross-check is advised before adopting in field)



Use pesticides as the last resort, in IPM

Vegetable Gardening: Approach for Nutrition and Wellbeing during Covid Pandemic

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Vegetables play an important role in nutrition, as rich source of carbohydrates, proteins, vitamins and minerals, hence known as protective foods. They also provide health protection on account of the presence of secondary metabolites of therapeutic importance. Vegetable gardening is a rewarding activity that can provide fresh, flavorful produce. It offers many benefits such as providing fresh air, landscape beautification and enjoyment including exercise. During this time, when people are working from home and students are learning at home, gardening can be a positive family-inclusive activity to adopt. Adopting a vegetable garden in backyard, balcony or terrace may be a way for adults and children to cope with boredom and help families gain a sense of security. It can be a good hobby as well as a relaxing recreational activity. **Gardening not only reduces stress through mental focus & meditation but also reduces stress through personal creativity.** Kitchen gardening, terrace gardening, container and vertical gardening will help us in the supply of fresh vegetables with minimum inputs. Vegetables like beans, peas, broccoli, sweet potatoes etc. are good sources of vitamin B₅ (pantothenic acid) which is often called anti-stress vitamin. Vegetables rich in folic acid such as kidney beans, broccoli, Brussels sprouts, cabbage, chicory, peas and green leafy vegetables can easily be grown in our home. Leafy greens are easy to grow and most sought after grown under home condition. Moreover market vegetables often have heavy load of pesticide residues, coloring agents and may be a source of fomite borne infection. Therefore growing own vegetables not only provides fresh supplies but also helps to calm the mind, keep ourselves busy, and to educate kids. It is the best means of entertainment in this condition where seeing the plants growing gives natural feeling of happiness as being creator of themselves.

People those can effort, may mix the poly/green house concept with such gardening, vertical gardening to varying degree, provide some space for play for kids, dinning space with sitting arrangement preferably with rural touch, thatched rooftops etc., along with decorative light arrangement. This will provide a restaurant like feel, when families cannot go out during lockdown or even won't prefer further going in future on unlocking also; they can derive the maximum benevolence from this beautiful blend of gardening concept, as suggested by us. *Stay indoors, Stay Safe*, the prime *mantra* for upcoming months.



Orange



Papaya



Hog Plum

Potted plants add beauty to vegetable gardens – proper decorative plan essential

Virtual Visit

About My SNS Organic Farm – My Subscription Group



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Our Farm situated just 25 km from Bangalore international airport, we are into organic best practices since 2015, 8 acres property, includes 3 acres of Grapes, 2 ac Papaya, 2 ac Guava on majority. Around 25% of my farm is agro-forestry, 500+ White Sandalwood Trees, 1000 + Melia Dubia Trees ,1000+ Mahogany Trees 20+ types of vegetables, 10+ types of fruits, also we have desi sheep, goats and Mudhol Dog. We use Solar Power to run borewell. We do desi cow-based farming, we have 2 Sahiwal desi cow. Cow dung and gomuthra dumped in to a 10k liter big tank along with fish waste all the left over farm Produce like Grapes, Chikku, Banna also we do collect from the nearby market, once it is decomposed, we pump it to roots of all plants in the farm once in a month. I started to brand our farm produce using a logo advertisement in FB, WhatsApp and intagram. Then I was introduced to Dr GK Mahapatro, Founder of *Vegetable Farmers Forum* (Head, IARI Regional Station, Pune) by Dr Srinivas Rao, ICAR-IIHR; during lockdown period.

As suggested by *Vegetable Farmers Forum* I started farm subscription model in mid-May 2020. Today we have 70+ SNS Organic Farm subscribers from Bangalore. Around 5 families have visited our farm and enjoyed as picnic spot and plucking their own fruits and vegetables and buying at rebate price. We have built a small hut for them to take rest, then can also do fishing in our pound and bring their food for lunch or they can cook them self in *desi* style we do all the arrangements for them we do provide 20% off on the fruits and veggies they buy in our farm additional 5% off if they buy for their neighbors.

Any one from Bangalore or nearby can subscribe to our farm and join our WhatsApp group, please use the below QR code to get the link to join our WhatsApp group.

Cultivation is Culture, Just NOT Commercial



SNS Organic Farm Tourism , Hospitality and Back2Root

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Conceptualized & Promoted by

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SNS Farm Kid's back2root Activities

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Native Skills Tree Claiming



Harvesting



Care and Love for Animals



SNS Farm Activities



Family Trinational Game



Cycling



Picnic spot for Family



500+ White Sandalwood Trees



1000+ Mahogany Trees



1000 + Melia Dubia Trees



Swimming Skills



Ploughing



Irrigation

Bt Brinjal: An Indispensable tool for Brinjal Farmers in India

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**Brinjal shoot & fruit borer is the serious problem, Bt-technology is the best bet,
But it is not approved in India, on bio-safety issues**

India is the second largest producer of vegetables in the world, but the average annual loss of vegetables is about 12 per cent which results in significant reduction in Indian agricultural economy (Manunayaka *et al.*, 2020). The major issues in vegetable production are lower market price, high input price, high cost of management for pest and disease, lack of high yielding variety seedling, lack of proper cold storage structures and losses due to natural calamity (Azad *et al.*, 2014). Brinjal (*Solanum melongena* Linn) is the fourth important vegetable grown by small and marginal farmers in India. Farmers encounter several problems during brinjal production and the major one is fruit and shoot borer (FSB - *Leucinodes orbonalis* Guenee), which results in 60 – 70 % of yield loss. Several pesticides gave optimal control over the pest but the pest has developed resistance to several insecticides. This aspect urged the need of novel pest management tool which may include GM crop (Das, 2017). Bangladesh is the first south Asian country to approve commercial cultivation of GM food crop. BARI (Bangladesh Agricultural Research Institute) developed four varieties of brinjal (BARI *Bt* brinjal-2, BARI *Bt* brinjal-4, BARI *Bt* brinjal-3, BARI *Bt* brinjal-1) for commercial cultivation. *Bt* brinjal-4 was genetic construction of ISD-006 variety with Cry 1Ac toxin

against FSB. *Bt* brinjal resulted in 47 per cent reduction in the cost of pesticides, which is equivalent to a reduction of US\$ 85.53 per hectare. An increase of 27.3 percent in gross revenues per ha was reported due to adaptation of GM brinjal crop (Ahmed *et al.*, 2019).

Field testing of GM crops is conducted by Biotechnology Regulatory Authority of India (BRAI), Ministry of Agriculture in compliance with the bio-safety and regulatory guidelines of the Ministry of Environment, Forest and Climate Change. The report of "Cultivation on Genetically Modified Food Crops-Prospects and Effects" (2012) states that the *Bt* brinjal cultivation was denied in India due to policy and regulatory constraint. MHB 80 *Bt*, MHB 9 *Bt* and MHB-10 *Bt* were the promising *Bt* brinjal hybrids against FSB (Khan and Borikar, 2017). Triple Helix (government, academia, and industry) model plays a significant role in understanding the networking between agricultural innovation systems (Hall *et al.* 2001). Major public-private partnership projects in India include *Bt* brinjal, *Bt* chickpea, Late Blight Resistance potato, GM mustard and *Bt* cotton. The Review Committee on Genetic Manipulation (RCGM) is not independent and it has failed to establish an independent regulatory system for GM crops. *Bt* brinjal is cultivated illegally in some parts of India and this is due to lack of ability of GEAC to control the illegal use GM crops. The major critics for cultivation GM brinjal and GM mustard is inadequacy in bio-safety data, and these data were not made public (Kumari and Mallick, 2017). The approval for commercial cultivation of *Bt* brinjal by Bangladesh makes illegal cultivation in India beyond its boundary of politics, governance, or risk. Hence approval of *Bt* brinjal cultivation is indispensable for Indian farmers.

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Diversity, Damage and Deliberation on Management of White grubs in Vegetable Crops

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White grubs are the serious insect pests that infest a wide range of agricultural, horticultural crops and forest plantations besides turf grass. These are also commonly known as May or June beetles and chafers and belong to family Scarabaeidae of Coleoptera. Scarabaeidae comprises of coprophagous (dung rollers) and phytophagous (white grubs) under six major subfamilies. Around 35,000 species of Scarabaeidae are known to occur world wide and 2500 species in India, where in 75% comprises of phytophagous forms including white grubs. The larvae of white grubs are the most damaging stages, which feed on the roots, rootlets, underground stem portions and result in wilting, drying and dying of the plants. The larval stage passes through three instars and the first two instars are less harmful while the third instar grubs cause maximum yield loss through voracious feeding. Of nearly 1500 species of white grubs in India, about 40 species have been documented as predominant in various crops across the country. In vegetables, few predominant species have been documented especially in potato, onion, carrot, sweet potato and spice crops like turmeric, ginger, etc. Of these, potato is worst affected. The species diversity of white grubs is high and varies with the crop, region and soil type. For instance, white grub species infesting potato crop in North India are different from those in South India. Though root damage due to larval stages is the most commonly encountered problem, of late, the adult beetles are also found to be defoliating several horticultural crops including both vegetables and fruits by feeding voraciously on the leaves causing significant yield losses. Recently, in the current year i.e. 2020, heavy incidence of white grubs was found on the French bean in Tamil Nadu, which was not reported earlier. The species diversity and damage intensity levels in the vegetable crops will be discussed with the crop, region, latitude and altitude. The management options addressing both adult and larval stages of white grub are herewith discussed.

Management strategies

- ✓ Adult beetles can be killed by spraying the insecticide on the host foliage soon after monsoon showers, as they emerge in large numbers and aggregate for feeding and mating.
- ✓ Light traps can be installed during dusk in endemic areas to attract the adult beetles and kill using kerosinized water.
- ✓ Manual collection of adult beetles from the host plants and destruction of the same.
- ✓ Installation of pheromone traps for collection of adult beetles of certain species of white grubs.
- ✓ Deep ploughing to expose the grubs, pupae and hibernating adults for predation by birds.
- ✓ Clean cultivation be regular raking up of field bunds, borders, around basin of the trees will expose the pupating grubs, pupae and hibernating adults, which can be killed further.
- ✓ Following of crop rotation helps in crops like potato with crops like clover and alfalfa, and in carrot with raddish will help in reducing the white grub population.
- ✓ Alteration of crop sowing/planting dates to avoid the losses due to white grub thus creating asynchrony between emergence of adult beetles and the crop vulnerable stage.
- ✓ Allelopathic effects of cover crops was observed in relation to white grubs , hence growing of fodder radish, *Raphanus sativus* in endemic areas will bring down the white grub population.
- ✓ Seed or seedling treatment with effective insecticide before sowing or planting.
- ✓ Soil drenching with chlorpyriphos 20EC at 5 kg a.i./ha has been found to be effective in reduction of white grub larvae, in groundnut and onion.

- ✓ Application of clothianidin 50 WDG was found very effective even at low dose (120 g a.i./ha), but it is not label-claimed insecticide (to be verified).
- ✓ Application of entomopathogens like *Metarhizium anisopliae* and *Beauveria bassiana*, *B. brongniartii*, *Bacillus* strains, etc.
- ✓ Soil application of entomopathogenic nematodes, *Heterorhabditis* and *Steinernema* species.
- ✓ Encouraging the bird predators like Indian myna (*Acridotheres tristis* L.), jungle crow (*Corvus macrorhynchos* Wagler), spotted owlet (*Athene brama*), etc.



White Grub Damage & Monitoring in Vegetable Crops

Nematode Problems in Vegetable Crops

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Major FIVE Nematode Problems in India – Vegetable Crops

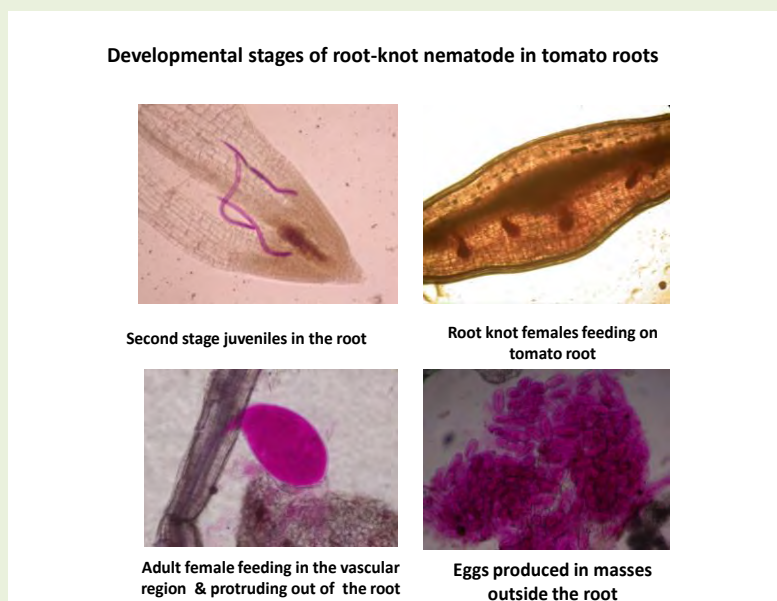
(Tomato, brinjal, okra, chilli, carrot & cucurbits)

(Courtesy: Economically Important Plant-parasitic Nematodes Distribution Atlas ICAR Publications)

Plant-parasitic nematodes are obligate parasites present in the soil that infest a large number of crops and are prevalent throughout the country. They feed as ecto-parasites, semi-endoparasites or endo-parasites

and cause symptoms like patchiness in the field, chlorosis, stunting and yellowing of plants. The symptoms are non specific except for some nematodes, like root-knot species where the nematode infection results in conspicuous galls on the roots.

Nematodes as seen under a stereoscopic microscope (40X)

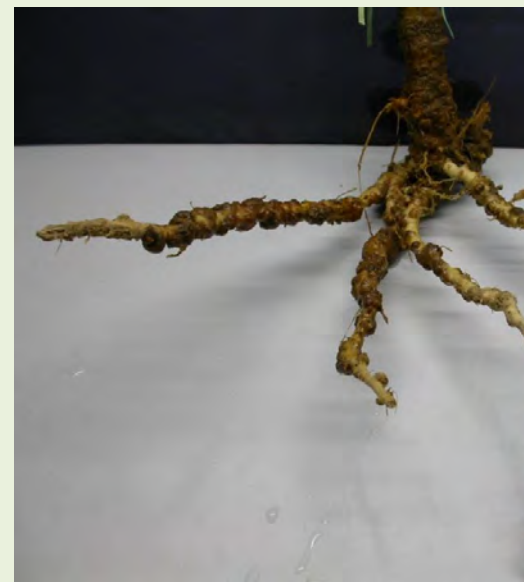


Though nematodes feed and infect almost all cultivated crops but they are more serious on vegetables and horticultural crops. The, root-knot species *Meloidogyne incognita*, *M. javanica* and *Rotylenchulus reniformis* which are polyphagous species are most prevalent in the country. Besides, the semiendoparasite *Pratylenchus* spp. and ectoparasites like *Helicotylenchus* and *Tylenchorhynchus* spp. are also associated with vegetable crops. The losses caused by these nematodes are highly variable, and depend upon the host cultivar, initial inoculum density of the nematode and various abiotic and biotic factors.

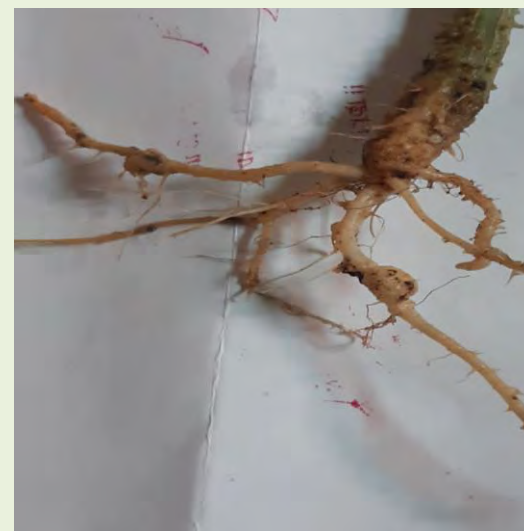
The root-knot nematodes *M. incognita* and *M. javanica* infects more than 3000 wild and cultivated plant species, including several weeds. The infective stage of the nematodes is vermiform and cannot be seen with the naked eye; because of which their presence is unnoticed by the farmer. The vermiform stage penetrates the root near the root tip, migrates to the elongation zone, anchors to the central cylinder, becomes sedentary and signals the parenchyma cells of the root cylinder to establish a feeding site called giant cell, which is metabolically very active. The establishment of the giant cell allows the nematode to withdraw nutrients from the vascular tissues of the plant. The vermiform stage develops into a globose female within a time of 25 to 30 days that lays 300 to 500 eggs in an egg-mass. These egg masses are visible on the roots as gelatinous extrusions. Externally, the root-knot infection is visible as macroscopic galls which vary in size in different plant species.



Galling in capsicum in open field



Poor root development and infection in Brinjal



Poor root growth in cucumber and knot infested soil

Root-knot species if introduced in protected cultivation become problematic unmanageable pests. They attain huge population densities on vegetables especially on cucumber and tomato cultivar. Their population densities reach from undetectable levels to upto 80 infective juveniles per cc soil on some tomato cultivar GS 600 or Kian cultivar of cucumber. Such high densities are attained on cultivation of long duration (6 to 7 months) hybrid cultivars, with deep rooted systems. The population build up in capsicum and cherry tomato is relatively low. The favourable temperature and moisture prevalent over a long period of time, enable nematodes to complete multiple (6-7) generations during the crop growth. Besides quantitative and qualitative yield losses, these nematodes predispose the crops to fungal and bacterial pathogens, especially *Fusarium* spp., *Pythium*, *Rhizoctonia*, *Ralstonia solanacearum* and *Pectinobacterium* spp. Predisposition occurs due to mechanical wounding of the roots, rhizosphere modification and disruption of resistance mechanism caused by the nematodes. Such interactions aggravate the damage caused to the crop.

NEMATODE PROBLEMS IN PROTECTED CULTIVATION

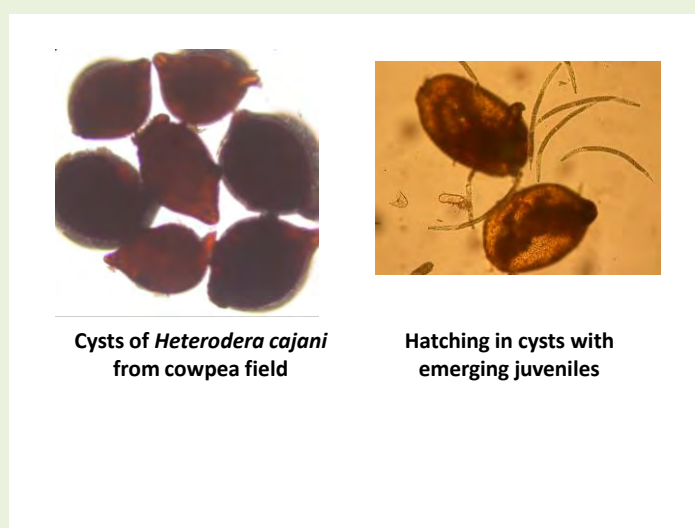
(Area under protected cultivation in India: 800 mHa)



Besides, the root-knot nematode on vegetable crops, the semi-endoparasite *R. reniformis* is prevalent in tropical and subtropical regions and is known to infect more than 300 plant species. Among vegetables it reproduces profusely on brinjal, tomato, okra, sweet potato, squash and lettuce. It may result in dwarfing, shedding of leaves, malformed fruits and seeds and an impaired root system. It is also reported from polyhouses.

The golden cyst nematode, *Globodera rostochiensis* and *G. pallida* are serious pests of potato that have spread from southern part of the country to the north, through seed potato. Earlier it was reported as a serious pest in Kodaikanal hills, Poomparai and Gundupatti regions of Tamil Nadu, but since 2010 it has spread to potato growing regions of Himachal Pradesh and Jammu. The nematode completes its life cycle in 35 to 40 days at conducive temperatures. The cysts can survive in the soil for more than 25 years and require the presence of host root exudates for hatching. The nematode infection results in reduced size of potatoes.

Another cyst forming nematode, *Heterodera cajani* infests cowpea, arhar, gram and all leguminous crops. It has a short life cycle of 18-20 days and completes several generations in a year.



The nematode causes quantitative and qualitative losses and is known to interact with the wilt pathogen *Fusarium udum* to aggravate the crop loss.

Majority of the farmers remain unaware of nematodes as pests as no conspicuous aboveground symptoms are observed on the plants. Various options of nematode management are available, such as crop rotation, bio-nematicides, soil solarisation, use of bio-nematicides and application of high organic matter can reduce nematode pest densities in the soil.

Crop rotation with non host crops helps in reducing the nematode pest densities significantly. The time for crop rotation however varies For root-knot species, two to three year rotation may be effective but for *Globodera* spp., at least 4 year rotation is required.

Non host crops for nematodes of vegetable crops

Meloidogyne incognita and M. javanica: *Brassicca juncea*, *B. oleraceae*, *Sesamum indicum*, *Crotolaria* spp.

Heterodera cajani: solanaceous vegetables crops, cotton and sugarcane

Rotylenchulus reniformis: *Daucus carota* (carrot), *Crotolaria juncea*, cereal crops like *Avena sativa* (oats), rhodesgrass (*Chloris gayana*), *Allium cepa* (onion) & *Sacharrum officinarum* (sugarcane) *Allium sativum*(garlic)

Globodera rostochiensis, G. pallida: non solanaceous crops like *Brassicca juncea*, *B. campestris*, garlic and onion

BIONEMATICIDES AVAILABLE IN THE INDIAN MARKET		
Bioagent	Formulations	Source
<i>P. fluorescens</i>	Biocure, Bioshield, Multiplex, Sparsh, Sudocel, Dagger-G	State Biocontrol Laboratory, Biotech International Ltd, Jeypee Biotech, Multiplex
<i>P. lilacinum</i>	Bionemator, Biocon, Bioact, PL plus, Multiplex Niyrantran, Abtec <i>Paecilomyces</i> , Bio-Nematon	IIHR Bengaluru, Agritechnol Infmn Centre, Bangalore, Kilpest India Limited, Madhya Pradesh, T Stanes and Company, Tamil Nadu
<i>T. harzianum</i>	Ecosom-TH	AgriLife Biosolutions, Hyderabad, AP
<i>T. viride</i>	Niprot	Pest Control India Pvt. Ltd. Niprot
<i>P. chlamyosporium</i>	Bionema, Biovert, Multiplex Versha, Nematofree	IIHR Bengaluru, Agritechnol Infmn Centre, Bangalore, International Panaacea Ltd, Delhi
<i>Bacillus firmus</i>	Bionemagon	AgriLife Biosolutions, AP

Soil solarization of nursery beds with a thin transparent polythene mulch of 60-100 microns for 4 to 6 weeks eliminates not only nematodes, but also propagules of pathogenic fungi and weeds. Addition of deoiled cakes of mahua, mustard or neem enhances the effect of solarisation. Incorporation of finely chopped fresh biomass from cruciferous plants like mustard and cabbage in nematode infested soil followed by covering the soil with polythene mulch for at least 2 weeks releases glucosinolates that are toxic to nematodes. This phenomenon called biofumigation can be easily adopted by vegetable farmers.

Besides, the addition of high organic matter in the soil and avoidance of chemical nematicides, promotes the build up of natural antagonists.



Brassicca juncea

Fine chopping of the fresh biomass

The use of chemical nematicides such as carbofuran or carbosulphan should be avoided or minimized for nursery beds or seed treatments. An ecologically sound integrated nematode management approach along with field sanitation can enable the farmer to minimize the damage and maximize his profits.



Natural antagonists of nematodes in soil under organic cultivation

Plant Quarantine: An Important Tool in Export of Vegetables

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Capacity building by Plant Quarantine ensuring pest-free export of vegetables

The strategies of plant protection have immense value on the perspective of crop production and protection, thus give assurance for a minimizing crop loss due to pest problem. Fresh fruits and vegetables are of major significance from the point of view of export, if produced and processed in scientific way, which could fulfill importing countries' requirement. Every year, a huge amount of fresh fruits and vegetables are exported from India to various countries including Nepal, Bangladesh, Japan, Singapore, Malaysia, Korea, Middle-east and Arab countries, European Union countries, United Kingdom, Canada, Mexico, Latin America, Australia, Turkey, Belarus and many more, generating huge revenue. Plant Quarantine plays pivotal role in this aspect ensuring pest free export of fresh fruits and vegetables, thus boosting farmers' economy. A specially designed Standard Operating Procedure (SOP) for Export Inspection & Phytosanitary Certification of Vegetables & Fruits to various countries has been developed by the Govt. Of India; and separate SOPs are prepared for European Union and some other countries like Japan as per specific phyto-sanitary requirement of the concerned country.

This is an inclusive approach involving National Plant Protection Organization (NPPO) of India, Department of Agriculture/ Horticulture of concerned state government, APEDA, exporters, farmers, approved pack houses and treatment providers as stakeholder. In each stratum, specific responsibilities are to be observed for ease of production and trade. This involve a chain process initiating from registration of farmers followed by monitoring and advisory by the state government authorities for good farming practices and sustainable use of pest management system, thus ensuring pest free and pesticide residue free yield. As per process of backward linkage, exporters can procure fresh fruits and vegetables from registered farmers and process them for phyto-sanitary clearance through pack-houses which are registered with NPPO i.e. DPPQ&S. Finally, the phyto-sanitary inspection and issuance of phyto-sanitary certificate is done by the officials of Plant Quarantine department. This process need to corroborate with the phyto-sanitary condition of the importing country, which is again, a major responsibility of Plant Quarantine department. For some countries, export of vegetables and fruits do not require involvement of pack-houses, so the farmers can directly do it if the cultivation is done taking care of the phyto-sanitary standards and requirements of importing countries. As Indian civilization and economy is inseparable from agriculture, in the wake of COVID-19 tremor, the stepping stone towards making self-reliant India is to rejuvenate agricultural economy. This can be achieved by promoting export of surplus vegetables and fruits from India, which have a big market demand in a wide array of countries. Plant quarantine can play as pioneer institution to lead the economic revival in rural India by extending appropriate guideline and monitoring over the export process of vegetables in coming days. Farmers, instead of selling their product to the handlers; on getting adequate technological help and advisory from competent agencies like APEDA, ICAR institutes, SAUs and DPPQ&S, can surely make it more profitable by taking part in direct export of their agri-yield to concerned countries abroad. Quality assured production and processing of vegetables as per phyto-sanitary requirement of the importing countries by active implication of relevant SOPs designed by Plant Quarantine can be a major tool to give the farmer economy an advantageous jump in the post COVID-19 situation to build *Self-reliant India*.



PQ inspection and detection of pest in Pack-houses

MODEL NUTRI-GARDEN: FIGHTING MAL-NUTRITION, THE MILLENNIAL MILESTONE IN INDIAN CONTEXT



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CONTEXT

India is a signatory to the Sustainable Development Goals (SDG) and mandated to end all forms of malnutrition by 2030. SDG2 relates to ending hunger, achieving food security and improving nutrition while promoting sustainable agriculture. In Odisha, despite of a noteworthy advancement in malnutrition reduction, 34% of children under 5 years of age still remain underweight and 34.1% remain stunted (NFHS-4, 2015-16). Nutrition is a critical requisite for the overall well-being of a person. It is even more imperative in the case of women, as their social positioning has historically suffered from different kinds of gender discrimination resulting in making them further prone to malnourishment and gender inequality. Thus, special attention needs to be given to women and children for fulfilling their health and nutrition prerequisites. Government of Odisha is making sustained efforts to transform the health system for achieving more equitable health and nutrition outcomes. This has resulted in accomplishing momentous developments in the health and nutrition sector across the state.

PUBLIC PRIVATE PARTNERSHIP

The renewed enthusiasm towards a broad-based multi-sectoral intervention emanates from the collaboration between Government of Odisha and Azim Premji Philanthropic Initiatives (APPI) when the two parties entered into a Memorandum of Understanding (MoU) in the presence of the Honorable Chief Minister, Shri. Naveen Patnaik, in December 2015. Considering the complementarity of nutrition-specific and nutrition-sensitive interventions, Government of Odisha developed an Odisha (Multi-Sectoral) Nutrition Action Plan (ONAP) and started devising and implementing convergent action plans with coordination of ten-line Departments.

PILOT PHASE

During 2014-2016, Azim Premji Philanthropic Initiatives made a partnership with Living Farms, a local NGO to mobilize community in Kalahandi and Rayagada districts of Odisha for establishing individual nutrition garden at their backyard to grow and consume fruits, vegetables, eggs and meat. The objective was to ensure dietary diversity through intake of vegetable and animal protein to prevent malnutrition among children, adolescent girls, pregnant women and lactating mothers. A post project evaluation by Valid International revealed a very positive result of this pilot project on reducing malnutrition.

SCALING UP

Based on the experience of working with Living Farms, Azim Premji Philanthropic Initiatives in partnership with Odisha Livelihoods Mission (under aegis of the Panchayati Raj & Drinking Water Department), scaled up and initiated a nutrition sensitive project “Mo Upakari Bagicha”.

A well-planned nutri-garden has the potential, when access to land and water is not a major limitation, to supply most of the non-staple foods that the targeted community needs, including roots and tubers, vegetables and fruits, legumes, herbs and spices, animals and fish. Roots and tubers are rich in energy and legumes are important sources of protein, fat, iron and vitamins. Green leafy vegetables and fruits provide essential vitamins and minerals, particularly folate, and vitamins A, E and C. Vegetables and fruits are a vital component of a healthy diet and should be eaten as part of every meal. Meat, chicken and fish are good sources of protein, fat and micronutrients, particularly iron and zinc. They are especially important in small children's diets to ensure normal growth and intellectual development.

Strategies and technologies for successful home gardening and nutrition education are contained in FAO's popular training material Improving Nutrition through Home Gardening. Separate training packages, specially designed to take account of regional food production and eating patterns and respond to the needs of diverse population groups, have been prepared for Southeast Asia, Africa and Latin America and are widely disseminated. FAO's Nutrition and Consumer Protection Division in conjunction with the Plant Production and Protection Division, actively collaborate with national agricultural extension, research, and training institutes, as well as with NGOs to train field staff, farmers' and women's groups, and schools teachers in gardening techniques and practical nutrition. Successful field projects have been implemented in Bangladesh, Bhutan, India, Indonesia, Niger, Somalia and Vietnam and training activities are implemented in Ghana and Kenya in Africa; Bolivia, Ecuador, El Salvador, Honduras, Nicaragua, and Peru in Latin and Central America; and in Grenada in the Caribbean.

MS Swaminathan Research Foundation (MSSRF) in collaboration with Integrated Child Development Scheme (ICDS) and Block Panchayat, Kalpetta has undertaken a multidimensional effort to reduce child malnutrition via „Anganwadi Nutrition Garden”, advocated the role of Nutrition Garden as a locally anchored and sustainable solution to malnutrition. MSSRF is establishing nutri-gardens in four highly malnourished districts of Indian states (Maharashtra, Odisha, Tamil Nadu and Uttar Pradesh). This project aims addressing the malnutrition covering 2000 families with emphasizing on location specific nutri-rich crop diversification, and nutritional security through capacity building, in rural areas. Nutrition security concurrently has to address 5 major components, 1) calories deficiency with adequate amount of food, 2) protein hunger or protein deficiency, 3) hidden hunger or micronutrients deficiency, 4) clean drinking water, hygiene and sanitation and 5) finally primary education to children.

Dr. Renu Swarup, Secretary of DBT and Chairperson at BIRAC, stresses on impact assessment of the nutri-gardens to get scientific evidence for future scalability. Needless to cite, as nutrition-responsive agriculture, integrating millets in nutri-gardens is important, inclusion of naturally bio-fortified plant species are to be given due priority.

In urban and peri-urban areas, also people should be aware of such developments, integrate nutrition garden concepts in their farmhouses, if available, discourage the present generation on all sorts of junk food. The four basic food groups, as outlined by the United States Department of Agriculture (USDA) are:

- dairy products (milk-derivatives),
- meat and eggs (such as fish, poultry, pork, beef, and eggs),
- grains (such as cereals, rice); and
- fruits and vegetables

The USDA recommendation for adults is that consumption of meat, eggs and dairy products should not exceed 20% of total daily caloric intake. The rest (80%) should be devoted to vegetables, fruits and grains. For children age two or older, 55% of their calorie intake should be in the form of carbohydrates, 30% from fat, and 15% from proteins. In addition, saturated fat intake should not exceed 10% of total caloric intake. This low fat, high fiber diet is believed to promote health and help prevent many diseases, including heart diseases, obesity and cancer.

Allergenic and highly processed foods should be avoided. Highly processed foods do not contain significant amounts of essential trace minerals. Furthermore, they contain lots of fat and sugar as well as preservatives, artificial sweeteners and other additives. High consumption of these foods causes build up of unwanted chemicals in the body and should be avoided.

Food allergies causes a variety of symptoms including weight gain, bloating, and water retention. They also may worsen chronic inflammatory conditions such as arthritis.

Nutrition-sensitive agriculture, focuses on increasing local food diversity plus nutrition education that emphasizes the need for diversified diets. This strengthens the linkages between increasing agricultural production and improving nutrition outcomes.

TEN Food groups in nutria-gardens and Role of vegetables

1. Cereals/Grains,
2. White roots and tubers and plantains
3. Pulses (beans, peas and lentils)
4. Nuts and Seeds
5. Dairy
6. Meat, poultry and fish
7. Vitamin-A rich fruits and vegetables
8. Dark green leafy vegetables
9. Other vegetables, and
10. Other fruits.

Nutrition Gardens

Nutrition gardens are home gardens, with properly selected nutritious and diverse vegetables and fruits with a specific attention to address the micronutrient deficiencies like iron and vitamin A. The nutrition gardens are grown on the principles of agro-ecology for biodiversity and resource conserving.

A good nutrition garden has the capability to fulfill the daily dietary requirements of a family by supplying most of the nutritionally rich vegetables, roots and tubers, and fruits, legumes, and spices. Roots and tubers are rich in energy and legumes are important sources of protein, fat, iron and vitamins. Green leafy vegetables and yellow- or orange-colored fruits provide essential vitamins and minerals; particularly folate, and vitamins A, E and C. These nutrient rich foods are supplemented in the household diet with the help of nutrition gardens. Usually Nutrition Gardens cover an area of about 1 to 5 cent located in a small area in the back/ front yard. Nutrition gardens in our country have a diversity of perennial and semi-perennial crops, trees and shrubs, well adapted to local climates and maintained with a minimum of inputs from market. They supplement staple-based diets with a significant portion of proteins, vitamins, and minerals, leading to an enriched and balanced diet. The integration of livestock and poultry activities into nutrition gardening reinforces food and nutritional security for the families as milk, eggs, and meat from home-raised

animals provide the source of animal protein. Even small fresh water fish ponds can also be incorporated into the nutrition garden space adding to the share of proteins and other nutrients available for the farmers.



Environmental benefits

Nutrition gardens initiate and utilize ecologically friendly approaches for food production while conserving biodiversity and natural resources. Individuals of the household, animals, and plants all maintain a symbiotic relationship within nutrition gardens. Livestock and poultry manure add a significant amount of organic soil matter, into the soil. The integration of livestock activities into nutrition gardening expedite nutrient cycling in ecosystem and help retain moisture.

Characteristics of a nutrition garden

1) Contain a diversity of plants; 2) production for family consumption; 3) occupy a small area; 4) locally available seeds and other inputs are recycled into the nutrition garden, 5) no use of synthetic chemical inputs, high yielding and hybrid seeds, 6) led by women, 7) use one's own labour and 8) growing locally appropriate seasonal crops etc.

Models of Nutri-garden: Circular, Rectangular and Gunny bag model.

Vegetable and fruits plants for Nutri garden: Pumpkin, Cucumber, Bottle gourd, Ridge Gourd, Basella, Bitter gourd, Snake gourd, Brinjal, Tomato, Okra, Chili, Amaranthus, Spinach, Coriander, Ipomea, Bean, cluster bean and cowpea, banana, Lemon, Papaya, Drumstick

Nutrition Project (*Mo Upakari Bagicha*)

Ajim Premji Philanthropic Initiative (APPI) signed a MoU with Government of Odisha to Improve Nutritional status of Women and Children across Odisha through mainstreaming Dietary diversity interventions by building Capacity and establishing a Nutrition Vertical within Odisha Livelihood Mission (OLM). Project aims at training of 7.5 lakhs women on Nutrition practices, establishing Nutri-gardens and Back yard poultry, across 750 GPs of 107 Blocks in all 30 districts of Odisha.

OLM has received Outlook Poshan Award from Vice President, Govt. of India for implementing this nutrition sensitive project, at present about 93, 719 Backyard nutrition gardens established across Odisha. APPI has identified and supported three resource NGOs (PRADAN, LIVING FARM and Harsha Trust) to work with OLM as Knowledge partners for this project. OLM has 3.5 Lakh Self Help groups and 13,000 community cadres to implement various interventions, so SHG platform and Community cadres of OLM have been contributing to implement this project.

Fighting malnutrition, particularly among children and women, remains a major concern and priority for the State Government of Odisha, India. Recent years, there have been some significant improvements in few health and nutrition indicators in the state. For instance, the Infant Mortality Rates (IMR) declined from 65 to 40 and rates of stunting among children under 5 years fell from 45 to 34.1%. However, the incidence of child wasting increased from 19.6 to 20.4%, and the rate of women with anemia rose from 51 to 61.1%, between 2005-06 and 2015-16. About 34.4 % of children under 5 in Odisha are underweight.

LESSONS LEARNT

One of the major lessons learnt from the project is about the potential role of the Government in scaling up nutrition sensitive interventions if it could be supported through training and capacity building by RNGOs. The role knowledge partners need to be recognized and rewarded. Another major lesson is the need for investments on capacity development of communities through development of a cadre of community extension agents as this is essential for sustainability of such a community driven initiative. Adult learning methods like storytelling, case study presentation etc. are part of Participatory Learning Action linking agriculture and natural resources to Nutrition (PLA LANN). This tool is used by community cadres in SHG -

level meetings for supporting / creating demand for nutrition garden, backyard poultry and goat rearing. PLA LANN has made the project activity, process easier to learn and use by the community. PLA LANN observed to have a good acceptability among community to explain the root cause of malnutrition and its solution

Apart from these, the government staff for implementing a project on addressing nutrition needs a lot of handholding support for atleast 3-5 years to achieve desired expected result. Government agencies are capable of delivery of such initiative at a large scale, if key people in the system opt for periodic desk and field review.



Nutri-garden – circular model



Nutri-garden – rectangular model

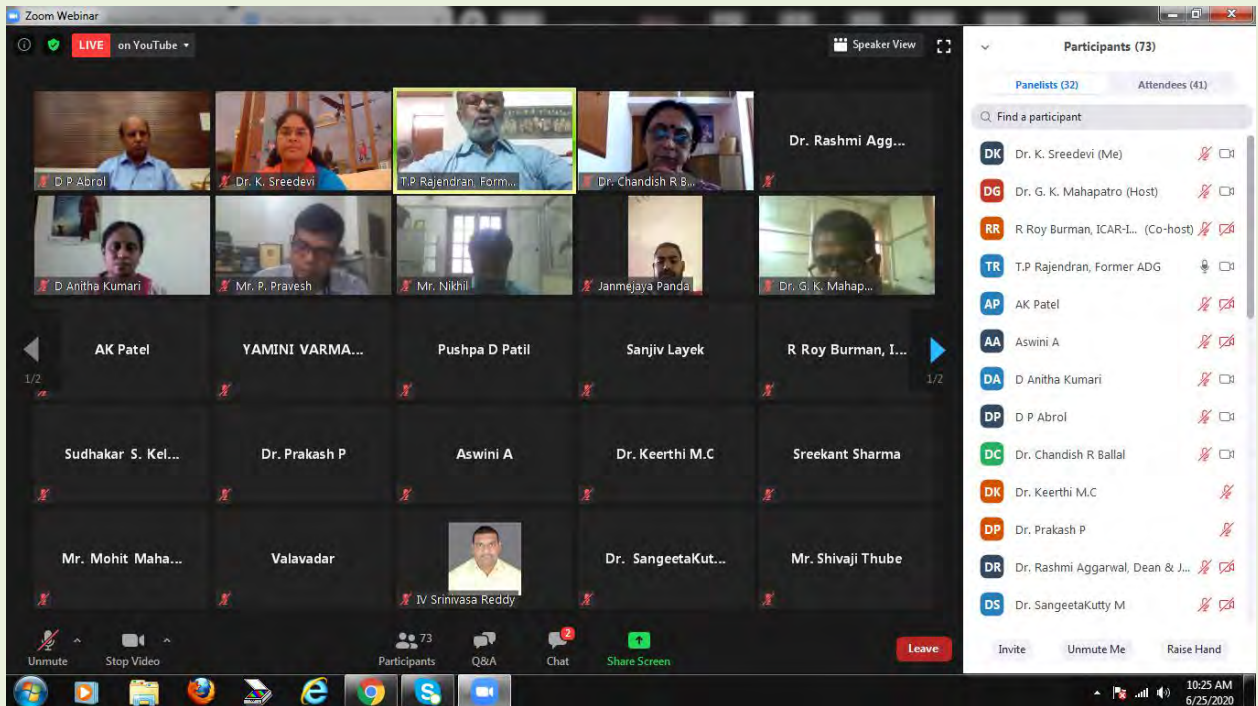


Nutri-garden – gunny bag model

END NOTE

The need of the hour is to strengthen community driven extension so that end beneficiary get access to quality extension services at an affordable cost. The model of converting community resource persons, into para professionals to deliver extension services has proven to be successful. But to sustain this provision of extension support, the community need to be encouraged to share some costs for this service provision. In the case of community animal health workers providing vaccination, artificial insemination and allied services, the community is already paying service charges and this supports community workers to sustain their livelihood. But in case of other agricultural support interventions, the beneficiaries are not yet ready to pay the service charges, as it is provided free by the Government agencies So this issue needs to be resolved by arriving at consensus among all stake holders as well as policy interventions at the highest level.

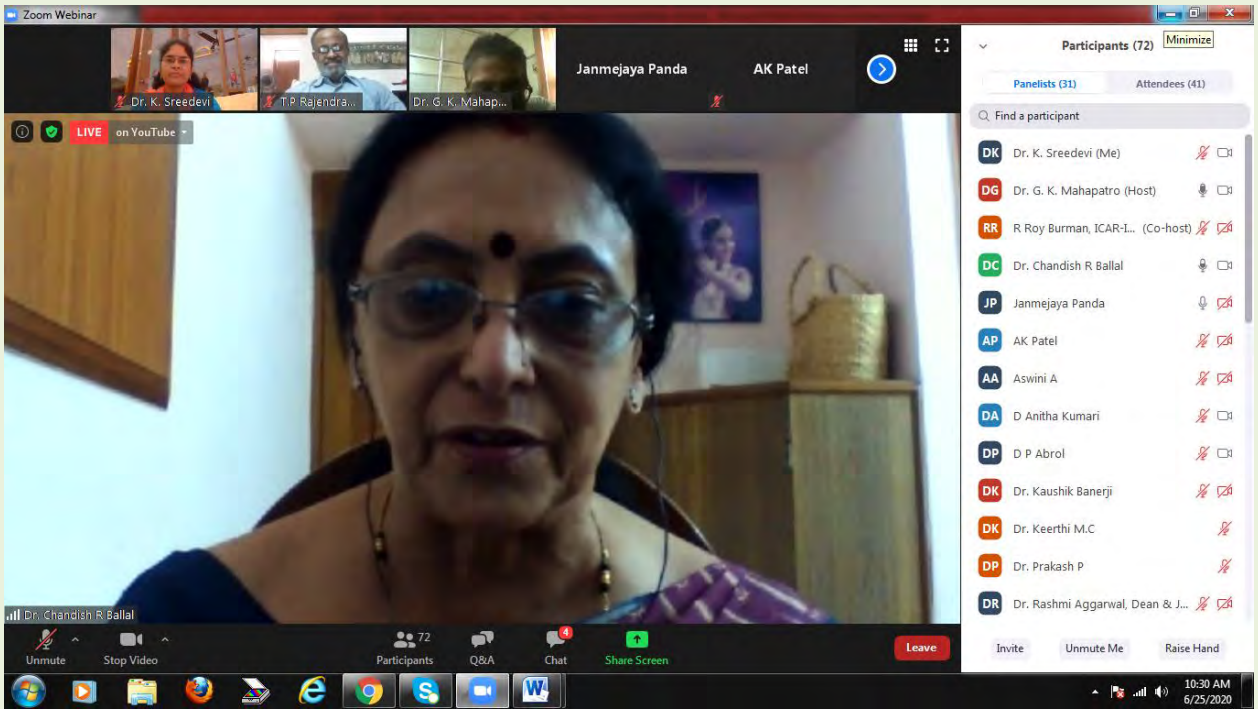
FEW CAPTURED MEMORABLE MOMENTS ONLINE NATIONAL WEB CONFERENCE VFF – 2020



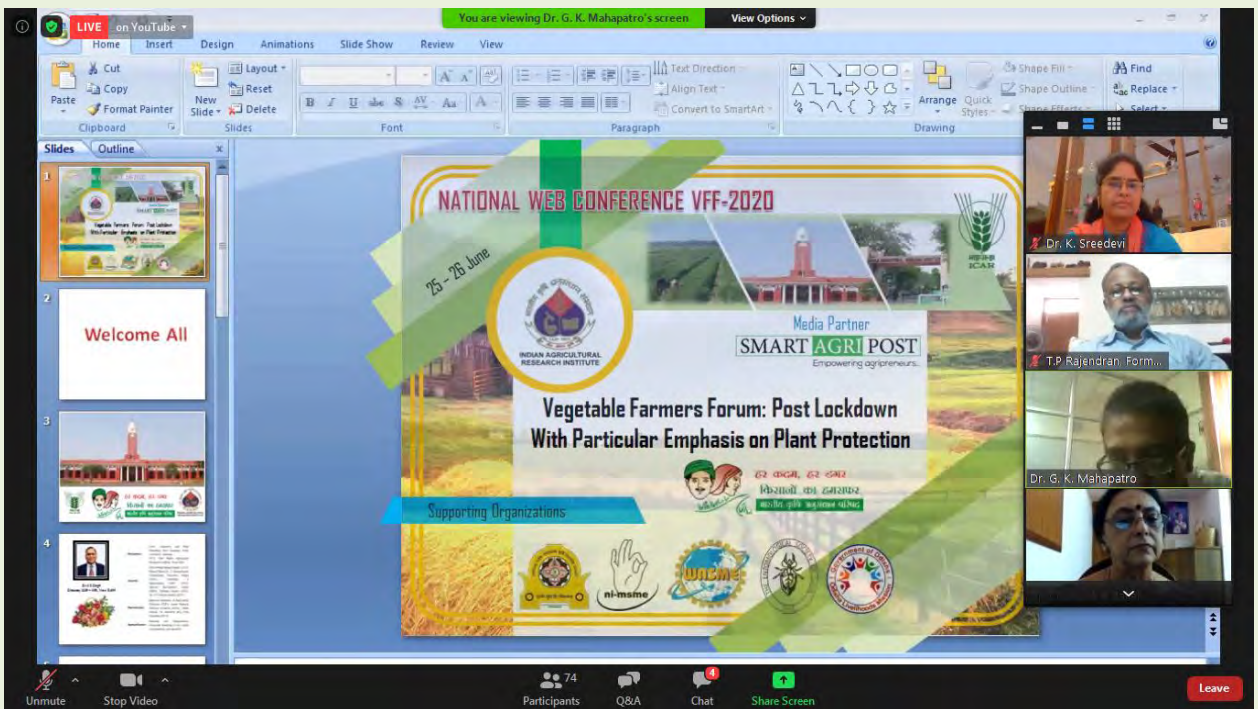
Web Conference – Inauguration (25 June 2020, 10 – 11.15 am)



Inaugural Address by our Advisor & Critic Dr TP Rajendran, Former ADG (PP), ICAR



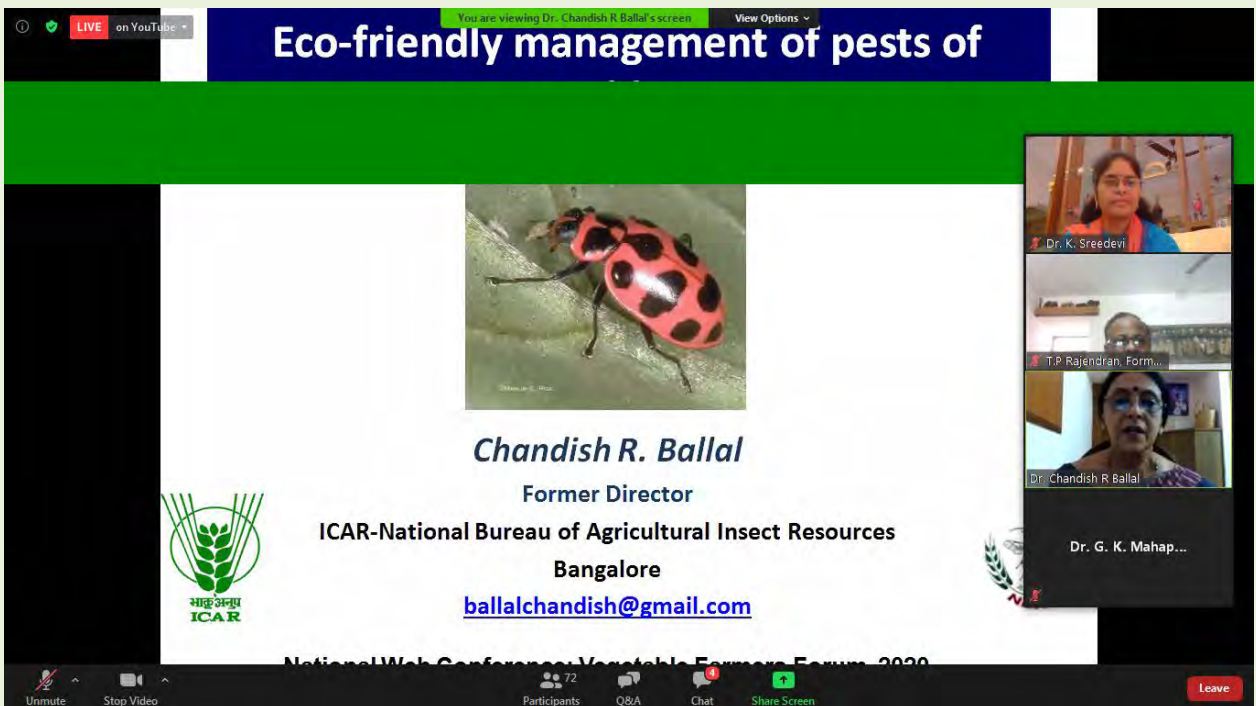
Dr Chandish R Ballal – Special Guest and Speaker of the Inaugural Session



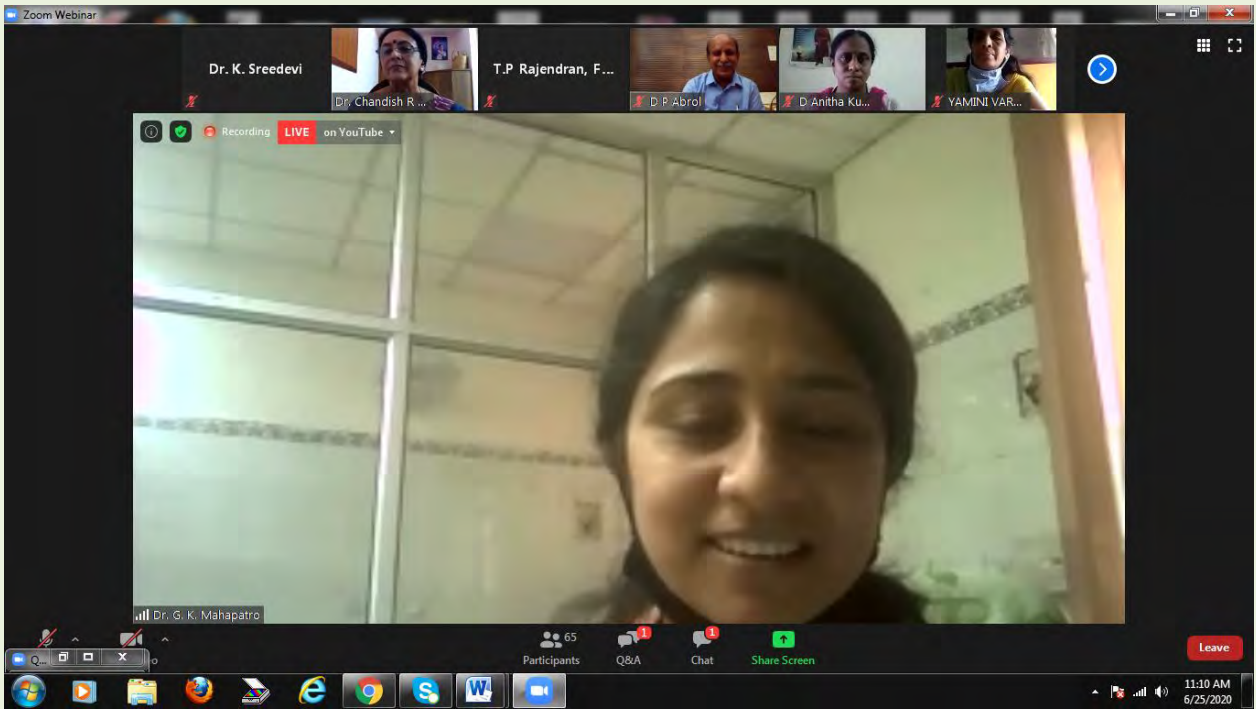
The Banner – National Web Conference VFF - 2020



Dr GK Mahapatro, Organizing Secretary of the Natwebcon VFF - 2020



Lead talk – Dr Chandish R Ballal (Former Director, ICAR-NBAIR)



Mrs Rajna S, Scientist (Entomology), IARI-New Delhi – anchoring the web conference



Dr DP Abrol, Dean, FoA, SKUAST, Jammu delivering the Lead Talk on Pollination Biology relevant to vegetable crops



Lead Talk on the Central Theme of the Web Conference



Indian in Lockdown – a cartoon on the presentation

Zoom Webinar

Dr. K. Sreedevi | D Anitha Kumari | Dr. Chandish R... | Mr. Shivaji Thube

Recording LIVE on YouTube

3. Consultancy in Crop protection

Shared extension bulletins, information sheets on the platform. Queries on virus problems in vegetable farming were addressed, like insect pests, insect-vectors, termite problems (website www.termiteexpert.in) nematode problems, plant diseases – fungal, bacterial and viral (ring spot virus tolerant lines, virus diseases of tomato, chilli, papaya etc).



<http://www.termiteexpert.in>

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Showcasing the www.termiteexpert.in webportal for farmers & other users

Zoom Webinar

You are viewing Dr. B. R. Mahapatra's screen

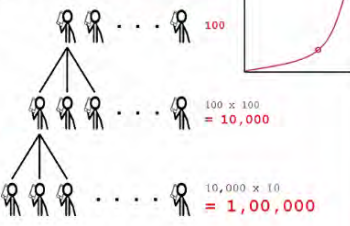
Dr. K. Sreedevi | D Anitha Kumari | Dr. Chandish R... | Mr. Shivaji Thube

LIVE on YouTube

Conclusion

- ✓ The response till-date is very good in this Forum.
- ✓ To ramify the network, make it reaching wider customers/clientele base, we proposed and has invited 100 nodal contact point persons (NCP) from various regions/sectors/themes. They will in turn connect to 100 farmers/beneficiaries.

Making a Chain



This way we reach 10,000 farmers in first level.
 Second level if each beneficiary point connects to at least 10 farmers, we arrive at 1 lakh clientele.

Participants (66)

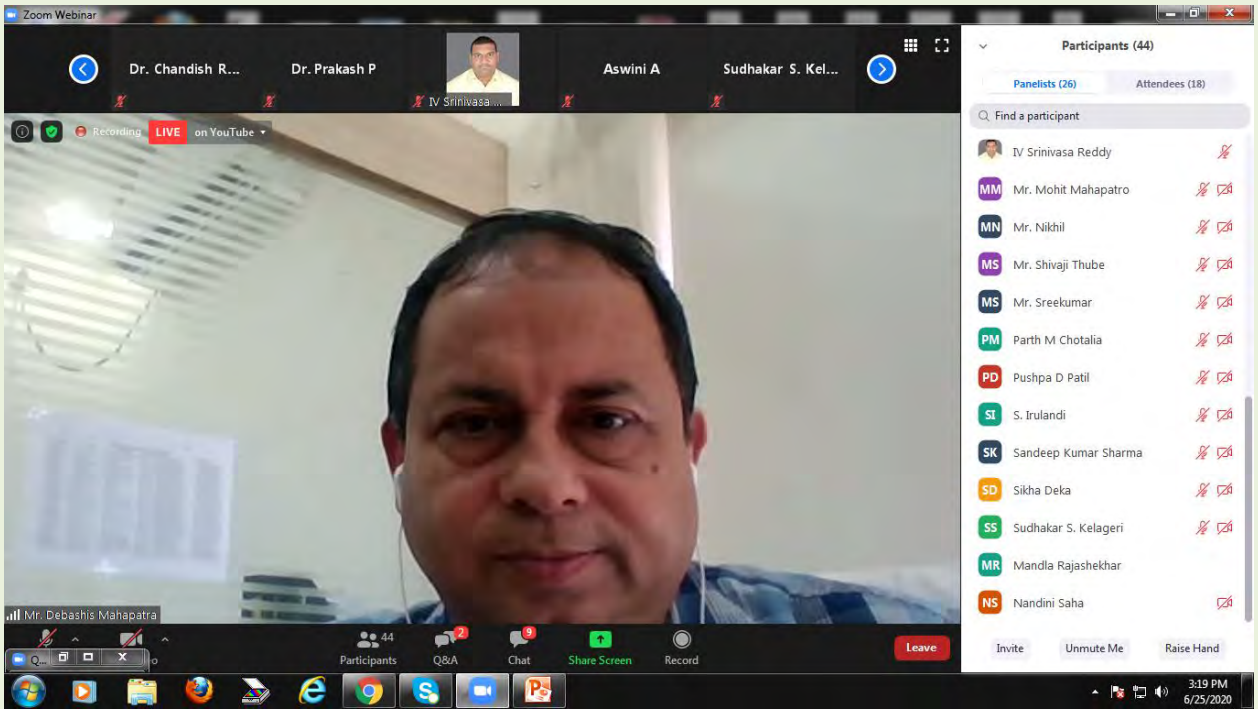
Panelists (29) Attendees (37)

Find a participant

MM	Mr. Mohit Mahapatro	🔊	🗨️
MN	Mr. Nikhil	🔊	🗨️
MS	Mr. Shivaji Thube	🔊	🗨️
NS	Nandini Saha	🔊	🗨️
PM	Parth M Chotalia	🔊	🗨️
PS	Pozhilarasi S	🔊	🗨️
PD	Pushpa D Patil	🔊	🗨️
SK	Sandeep Kumar Sharma	🔊	🗨️
SD	Sikha Deka	🔊	🗨️
SS	Sudhakar S. Kelageri	🔊	🗨️
YV	YAMINI VARMA C.K	🔊	🗨️
BT	B Thirupam Reddy	🔊	🗨️
	Dr. A. K. Singh	🔊	🗨️

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Vegetable Farmers Forum: tangible targets



Sri Debashis, State Project Manager, Nutri-gardens, OLM-APPI, Odisha



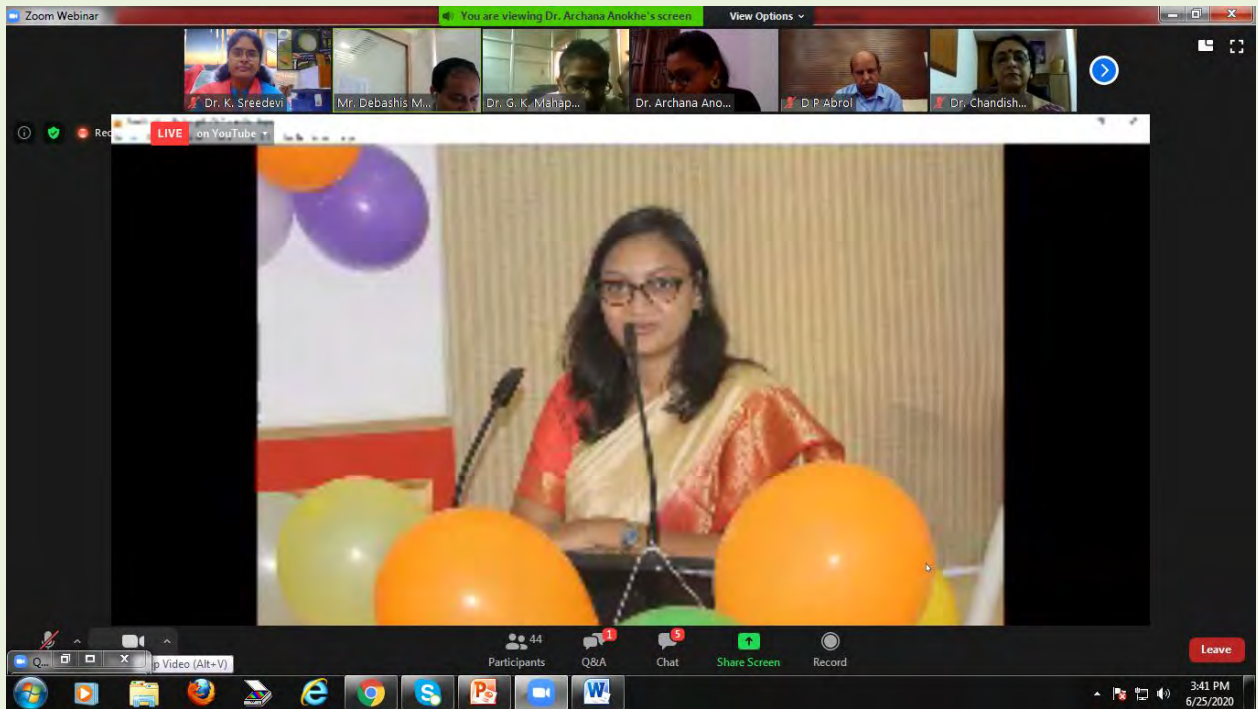
Interaction Session – web conference

Cultural-cum-motivational Programme by Children

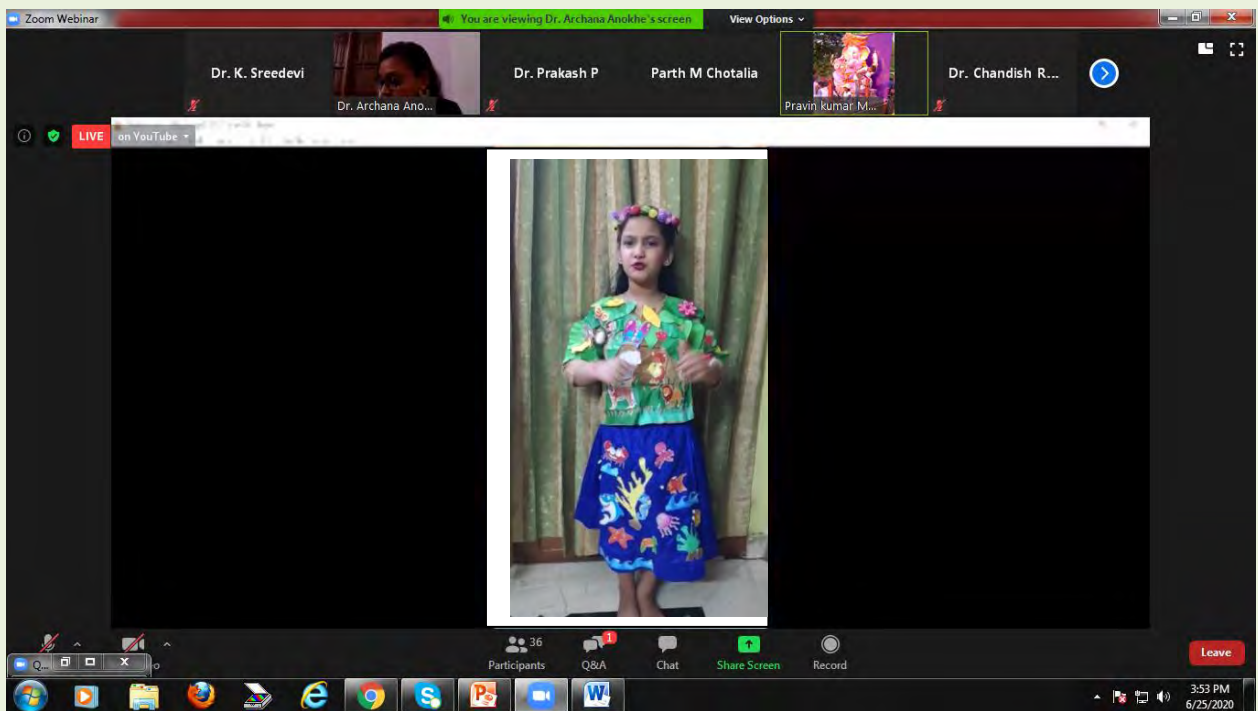
Organized

by

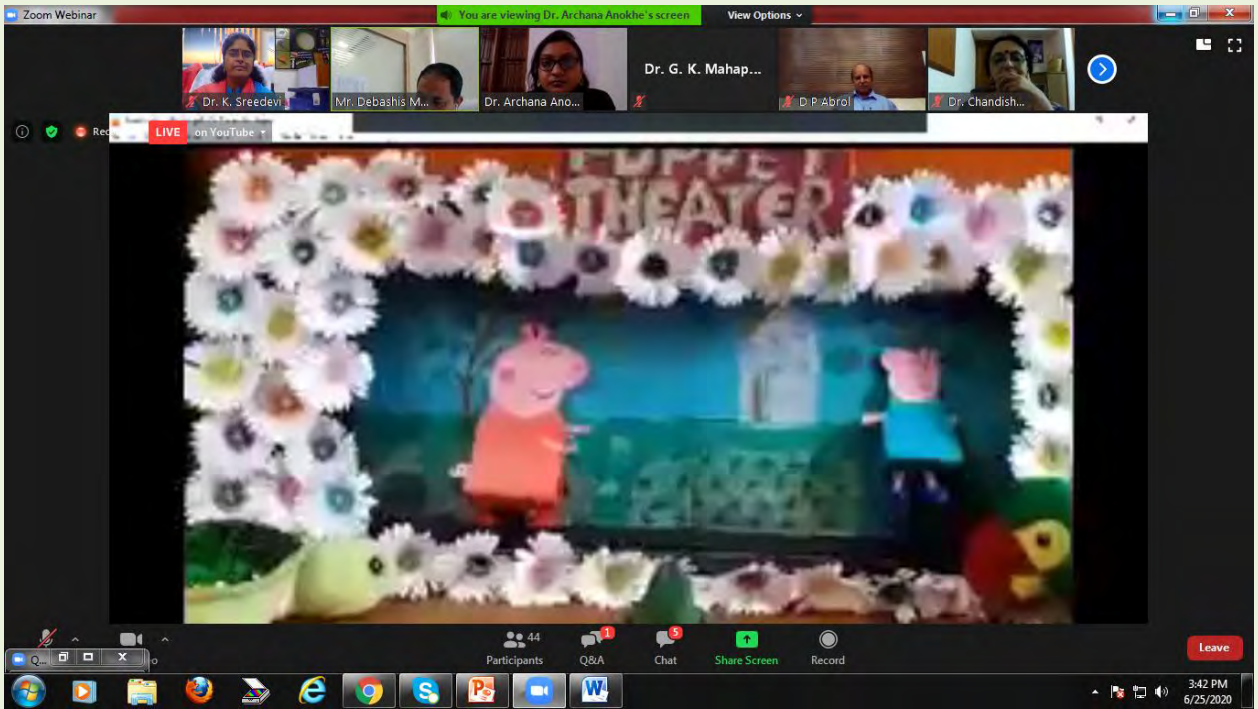
DIIL – Domain of Intellectual & Imaginative Littles



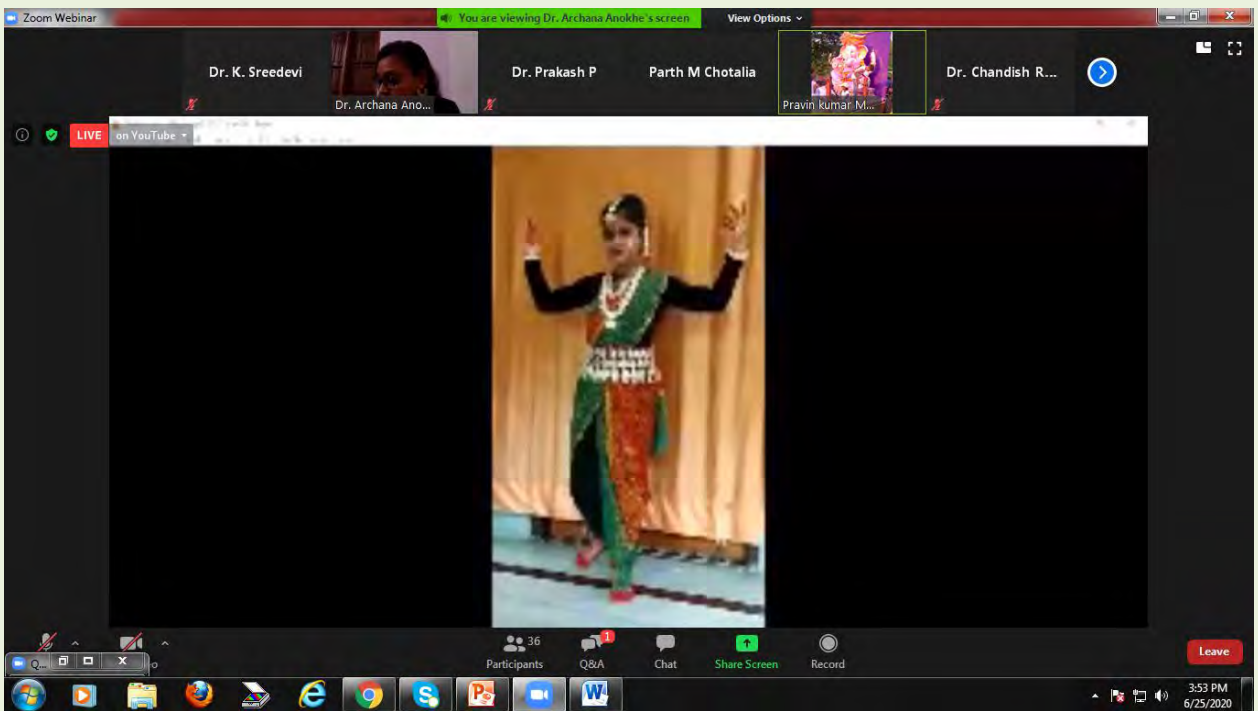
The Children of various schools from Delhi, Pune and Angul (Odisha) - participated



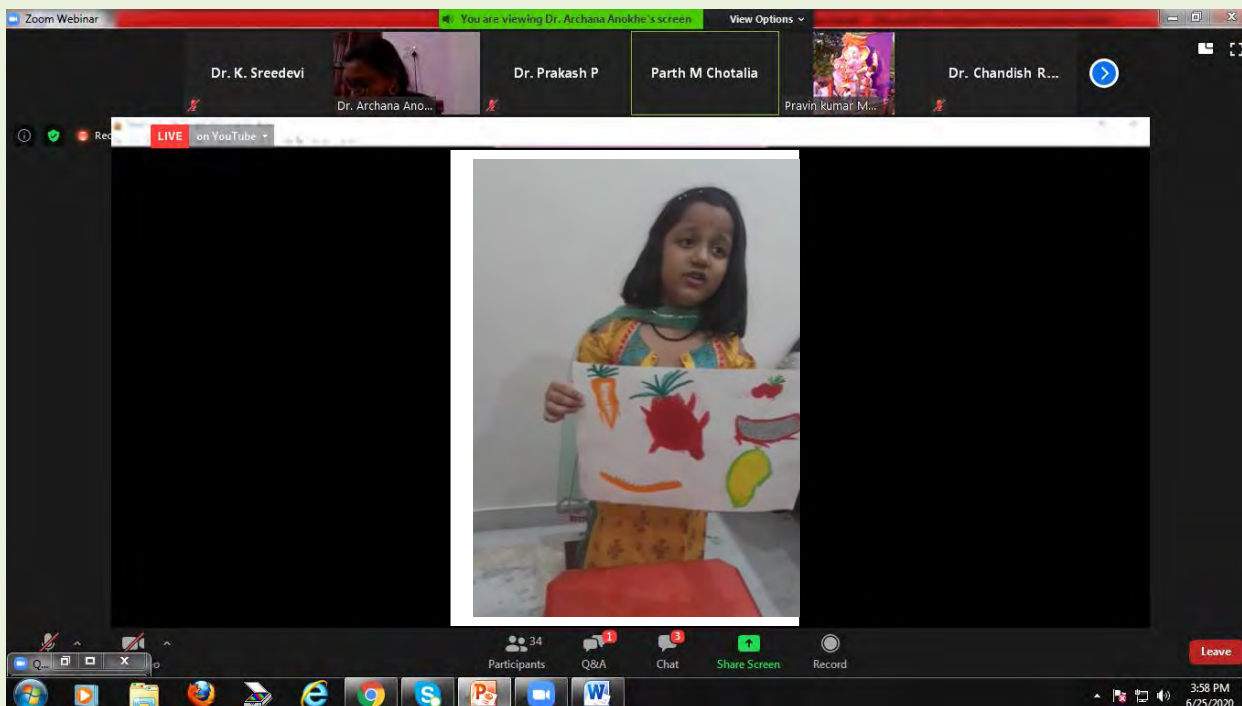
Paher – Most appreciated performance (First Prize)



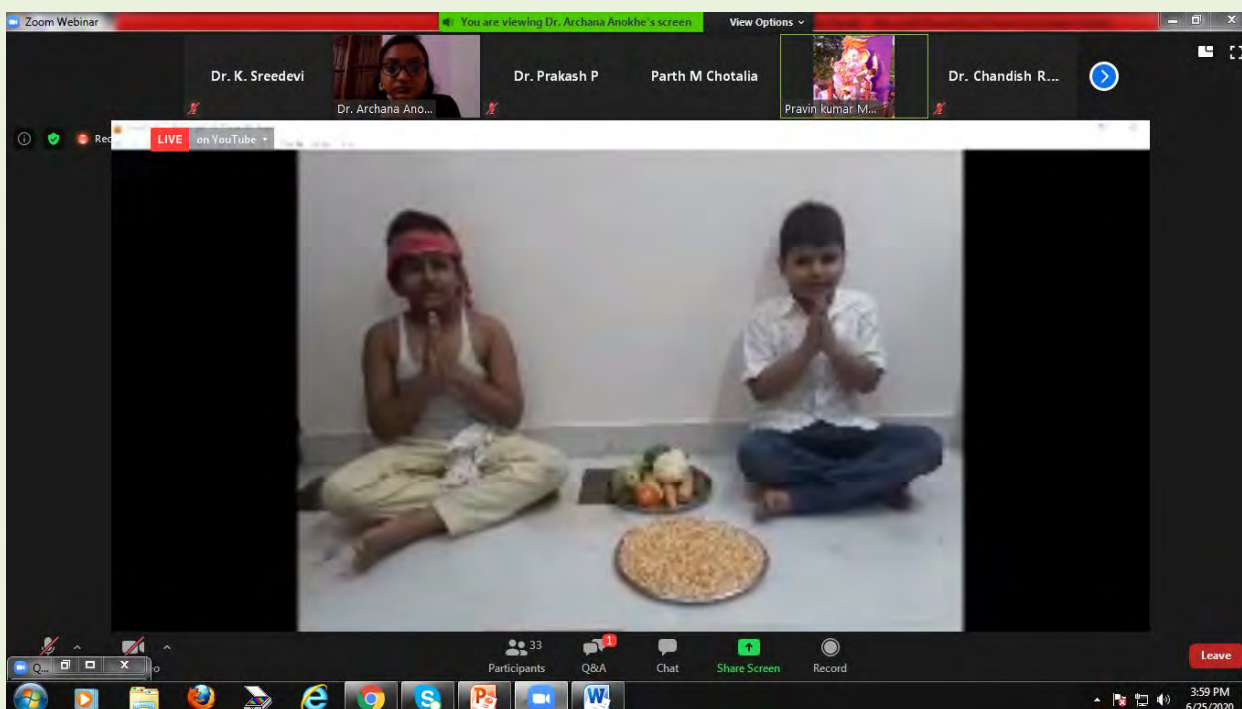
'Peppa Pig' Puppet Show on Vegetable Farming by Shivansh (Second Prize)



Aradhy – Dance performance – Third Prize, Children Cultural Programme



Arohi – Veggie chart narration – Third Prize combinely, Children Cultural Programme



**Daivik & Ashmit – (Jugalbandi, Farmer and Customer bargaining)
Consolation certificate award - Children Cultural Programme**

Vegetable Farmers Forum Photo-competition

The competition held on forum in May 2020 month, was participated by few farmers and children, their pictures/photographs were selected and published as follows. Appreciation certificates are sent to them online.



Covid period relief work at Lamtaput (Odisha) by PRADAN (NGO)



My kitchen Garden



Peppa pig following social distance – a kid's take



'Light a Lamp' for Corona Warriors



Watering the Plants in commonplace



Few Selected photographs – photography competition of the Forum during covid-19 lockdown



The culmination of conference online in decorum – with National Anthem

JAI HIND

GLIMPSES OF DIIL

Domain for Intellectual & Imaginative Littles

*“Flowers are a proud assertion
That a ray of beauty outvalues
All the utilities of the world.”*

A group of small kids of Kaveri Apartment initiated their own unit on the auspicious occasion of *Ganesh Chaturthi* 2009.



Birth of DIIL on the auspicious day of Ganesh Chaturthi 2009

The word **LITTLE** here means not only for the kids of Pusa campus; but certainly also for an adult as within everyone's soul a kid resides. Though the prime objective of **DIIL** is protection to the violation of Human Rights at the same time nurturing duties & responsibilities in the society yet it encompasses many other goals too. It adopts and tries to teach good happenings in every part of the world. It observes **International Days** of the UNO. It joins hand with the **Anna Movement** teaching non violence and **Swatch Bharat Abhiyan** of Prime Minister Shri Narendra Modi. It reminds ancient Indian Culture by organizing **International Yoga Day** on February. Glimpse of DIIL's achievement is appended herewith.

Martin Luther King said: *Injustice any where is a denial of justice everywhere*. DIIL is originated in the Pusa that is why it promises to continue social welfare activities. It believes in Eternal Happiness, Tolerance, Equality, Justice and Universal Brotherhood. So it takes away its members from violence, conflict and controversy. One of the little flowers of DIIL says “let not combat terrorism by violence means instead wipe out each and every evil from the core of society of the world and it automatically vanishes with time”. Small sized Words but from Big Heart are to be followed.

The first formal event of DIIL was Children's Day Celebration, at Faculty Club, on 14 Nov 2009. Amid the fun and cultural events, DIIL proposed for a children's park on the Kaveri Ground, to Mrs Gupta (wife of Director, then). Fortunately with active leadership of our faculty scientists it came to light, though took little much time.

In the tough journey through the ups-and-downs, few words of the Mahatma Gandhi reflect the mind **First they ignore you, then they laugh at you, then they fight and then you win**. Certainly we have to bear pain if we have taken the responsibility. In the near coming days if everything goes well we are interested to work for science and technology by organizing “**Kalam Ko Salam**” with an exhibition on space science and art.



Celebrations on Birth of DIIL 2009

DIIL at 'Anna Anti-corruption Andolan'



CHILDREN'S DAY CELEBRATION 14 Nov 2009 - Various Cultural and Fun Activities

Human Rights Day 2013



Children marched on Human Rights Day, with placards on the campus road for Awareness



DIIL was adopted with the approval of Executive Committee, Faculty Club, IARI

Human Rights Day 2014



Dance program by kids



Ramp show by children



Group Discussion - My Rights & Duties



A Dance for 'Unity'



CHILDREN'S DAY CELEBRATION 14 NOV 2015



April 22, Mother Earth Day



3rd December, International Disabled Day, 2018



June 7, World Food Safety Day, 2019



December 10, International Human Rights Day, 2019

DIIL's Special Thanks To:

We do acknowledge wholeheartedly, the Secretary and President of Faculty Club, ICAR-IARI for lovingly adopting our unit under its ambit, inspiring us in our activities, our respected authorities like previous Directors Dr HS Gupta, his wife; and also Dr T Mohapatra and his wife, for the support and inspiration. We happily acknowledge as well the NHRC, PUCL, Ladies Club, Inderpuri-A Khada Park Maintenance Committee, Arya Samaj Mandir, Inderpuri (New Delhi) and Others for their helping hands at the time of need.

D I I L

Domain for Intellectual & Imaginative Littles

Founder

Mrs Madhumita Panigrahi
M.A. (Human Rights & Sociology), LLB
LAWYER & ACTIVIST, HUMAN RIGHTS

Co-Founder

Mohit Mahapatra
Std XI, The Sanskriti School, Chanakyapuri, New Delhi-110021



Web Conference Recommendations

Hindi

‘कोविड 19 महामारी के दौरान सब्जियों की खेती’ विषय पर राष्ट्रीय वेब सम्मेलन का आयोजन

अनुवाद

सदस्य, राष्ट्रीय सलाहकार समिति, राष्ट्रीय वेब सम्मेलन

डॉ (श्रीमती) स्वाती चड्ढा, हिंदी अधिकारी, सीएसआईआर - एनसीएल, पुणे

सब्जियों की खेती के लिए सर्वोत्तम तरीकों और देश में किसानों के सामने आने वाली चुनौतियों पर विचार-विमर्श करने के लिए आईसीएआर – आई ए आर आई, पुणे स्टेशन द्वारा दो दिवसीय राष्ट्रीय वेब सम्मेलन (25-26 जून 2020) का आयोजन किया गया। आई ए आर आई पुणे स्टेशन के प्रमुख वैज्ञानिक डॉ. जी के महापात्रो द्वारा लॉकडाउन अवधि के दौरान सब्जी की खेती करने वाले किसान फोरम (VFF) बनाया गया था, जो अपनी तरह का अनूठा प्रयास है। इसके द्वारा सभी हितधारकों को डिजिटल माध्यम से जोड़ने, सब्जी की खेती से संबंधित अपनी चिंताओं को साझा करने और किसानों के सामने आने वाली समस्याओं का समाधान खोजने का अवसर प्रदान किया गया है।

वेब सम्मेलन की अनुशंसाएं –

यह सम्मेलन “*Vegetable Farmers Forum: Post Lockdown with Particular Emphasis on Plant Protection*” नामक विषय पर केंद्रित विषय था। इस वेब सम्मेलन के माध्यम से फोरम द्वारा सभी हितधारकों, विशेष रूप से उत्पादकों और जनता को कुछ बिंदुओं पर विचार करने का सुझाव दिया गया।

- वर्तमान में वैज्ञानिकों द्वारा अनुसंधान प्रयासों और देश भर में विस्तार एजेंसियों सहित विषय वस्तु विशेषज्ञों के ज्ञान पर ध्यान केंद्रित किया गया है जो टिकाऊ और लाभदायक सब्जी खेती पर केंद्रित है। मुद्दे अधिक गहन हैं, क्योंकि मार्केटिंग और कटाई के बाद की प्रक्रियाओं के अलावा पर्यावरणीय सुरक्षा और मानव स्वास्थ्य इत्यादि सभी दांव पर है। ताजी सब्जी वाली फसलों की खेती सहित फसल की पैदावार को उत्पादकों के साथ ज्ञान बैंकों के सुसंगत सहयोग की आवश्यकता है।
- हाल ही में संशोधित आवश्यक वस्तु अधिनियम (ईसीए -1955) ने आवश्यक वस्तुओं की सूची से प्याज और आलू जैसी सब्जी वस्तुओं को हटा दिया; लेकिन ये हमारे दैनिक भोजन की टोकरी और व्यंजनों में आवश्यक वस्तुएं हैं। इन कृषि- वनों की अत्यधिक पैदावार वाली फसलें अक्सर अनुचित रूप से कम बाजार मूल्य में लाई जाती हैं।

खराब कृषि अवसंरचना और कोल्ड स्टोरेज सुविधाओं के अभाव में किसान फसल का ज्यादा भंडारण नहीं कर सकते हैं और संकटपूर्ण बिक्री के कारण खराब होने वाली सब्जी का मूल्य कम हो जाता है। इस संदर्भ में खेत के फाटकों पर या

निकट स्थान पर प्राथमिक और माध्यमिक प्रसंस्करण के साथ ऐसी वस्तुओं के कटाई के बाद के प्रबंधन की स्थापना की जानी चाहिए। सूक्ष्म, लघु और मध्यम उद्यमों (एम एस एम ई=MSME) को हर जिले में सब्जी खेती समूहों (वीएफजी) के साथ शामिल करने के लिए उचित प्रोत्साहन के साथ प्रोत्साहित किया जाना चाहिए ताकि यह देखा जा सके कि उनके लिए नियमित रूप से अनधिकृत बाजार है। वास्तव में यदि MSMEs अनुबंध सब्जी उत्पादन में प्रवेश कर सकते हैं, तो सहजीवी लाभ होंगे जो काफी बदलाव ला सकते हैं। 'बीज से बाजार' तक एंड-टू-एंड सब्जी उत्पादन एमएसएमई प्लेटफार्मों के माध्यम से किया जाना है।

- वेब-कॉन्फ्रेंस में कृषि गेट समूहों के प्रसंस्करण और मार्केटिंग के लिए सब्जी किसान समूहों और एमएसएमई की बेहतर सार्वजनिक-धारणा और प्रभावी सार्वजनिक-निजी-भागीदारी को प्रोत्साहित करने का अत्यंत प्रभावी सुझाव दिया गया। हमने सच्चे अर्थों में पब्लिक-प्राइवेट पार्टनरशिप की संस्कृति को विकसित करने की पूरी कोशिश की।

• क्लाउड-सेवा केंद्रित दृष्टिकोण द्वारा हमारी आवश्यकताओं की पूर्ति

डिजिटल डिक्शनरी में क्लाउड कंप्यूटिंग शब्द काफी लोकप्रिय है, उसी शैली को हमें अपने संसाधनों, बौद्धिक और वित्तीय, मूर्त और अमूर्त सामग्री - एक एकीकृत दृष्टिकोण में सभी पर ध्यान केंद्रित करने की आवश्यकता है। टुकड़ों टुकड़ों में विभाजित दृष्टिकोण काम नहीं करेगा और इस प्रकार हमारे सीमित संसाधनों पर दबाव जारी रहेगा।

टमाटर की तरह प्रमुख सब्जी फसलों में निजी बीज कंपनियों (> 90%) से कीट अतिसंवेदनशील संकर बीज की देशव्यापी खेती के कारण वेब-सम्मेलन कीट परिदृश्य में प्रतिमान बदलाव को दर्शाता है। नए वायरस और अन्य रोगजनकों का परिचय और कीट-मकोड़े भी संभावित खतरे हैं।

- यह प्रस्तावित है कि पॉलीहाउस / ग्रीन हाउस सहित मिट्टी के जैविक कार्बन के 0.8 और उससे अधिक प्रतिशत तक खेतों में सब्जी की खेती की जानी चाहिए। इस कृषि-पारिस्थितिकी के कारण कीट भार प्रबंधन को अच्छी तरह से विनियमित किया जा सकता है। खेतों में मिट्टी के कार्बनिक कार्बन को बेहतर बनाने के तरीकों को प्रचारित और अपनाने की आवश्यकता है।
- इस तरह की स्थितियों की सुनियोजित सर्वेक्षण और सावधानीपूर्वक निगरानी, राष्ट्रीय और राज्य अनुसंधान निधि के माध्यम से अनुवर्ती निगरानी की सख्त आवश्यकता है। ऐसा करने का एक प्रमुख तरीका प्रत्यक्ष कीटों के साथ-साथ पौधों के रोग वैक्टर के लिए अर्थात् सैप-चूसने वाले कीड़े (एफिड्स, व्हाइटफ्लाइज, थ्रिप्स आदि) अप्रत्यक्ष रूप से नेमाटोड सहित गैर-कीट जीवों की सख्त निगरानी करना है। 3 R (resistance/ प्रतिरोध, resurgence / पुनरुत्थान और residue aspects/ अवशेषों से संबंधित पहलू) का सावधानीपूर्वक निरीक्षण किया जाना है।
- सब्जियों (विशेषकर सलाद फसलों में) में कीटनाशक-अवशेषों की समस्या अधिक महत्वपूर्ण है अतः किसानों द्वारा उचित देखभाल और सावधानी बरती जानी चाहिए। नियमित हस्तक्षेप, सामान्य बाजार से लाई गई सब्जियों के नमूनों में अवशेषों का पता लगाने के माध्यम से निगरानी को प्राथमिकता दी जानी चाहिए।
- भारत में खेती की प्रथा लगातार बदल रही है, खासकर महाराष्ट्र जैसे सब्जी वाले इलाके में, जहां अधिक से अधिक क्षेत्र अब संरक्षित या ग्रीनहाउस स्थिति में हैं, अक्सर कीटनाशकों का अंधाधुंध उपयोग होता है। अंतर्राष्ट्रीय व्यापार और यात्रा ने इस क्षेत्र में नई प्रजातियों और उपभेदों के साथ वेक्टर समस्या को जटिल कर दिया है,।

मंडियों में मूल्य हानि का सामना करने और देशव्यापी तालाबंदी के कारण निर्यात न हो सकने के फलस्वरूप किसानों को दोहरा झटका मिला। आपूर्ति-शृंखला, बैंक ऋण प्रणाली की समीक्षा क्लाउड-केंद्रित

दृष्टिकोण के संदर्भ में की जानी है। देश में जहां जरूरत 42,000 मंडियों में से केवल प्रचलित 7,000 मंडियां हैं। बुनियादी ढांचे, भंडारण सुविधाओं, परिवहन और मार्केटिंग रणनीतियों को मजबूत करने में बड़े पैमाने पर ध्यान देने के लिए जमीनी स्तर पर कार्य किए जाने की आवश्यकता है। संशोधित ईसीए- 1955 किसानों के पक्ष में जाना चाहिए, न कि दलालों के लिए; अनिवार्य रूप से उपयुक्त तंत्र को ईमानदारी से बनाया जाना चाहिए।

- वर्तमान में भारत में ICAR जैसी सरकारी एजेंसियों और SAUs जैसे प्रमुख निजी उद्योगकर्ताओं के साथ मदर डेयरी जैसे F & V आपूर्ति श्रृंखला प्रणाली में बहुत कम सहयोगी प्रयास हुए हैं। कॉरपोरेट सोशल फंडिंग रिसर्च (CSF) जैसी कार्यप्रणालियों के बाद बाजार केंद्रित अनुसंधान आवश्यकताओं और वित्त पोषण के लिए एक क्लाउड केंद्रित दृष्टिकोण भी सरकारी प्रतिष्ठान पर दबाव जारी करेगा।

सहकारी जैविक कृषि समूहों, सब्जी उत्पादक समूहों, स्वयं सहायता समूहों, ग्रामीण आत्मनिर्भरता के लिए गांवों में न्यूट्री-गार्डेंस, सब्सक्रिप्शन फार्मिंग जैसे प्रगतिशील दृष्टिकोण - उपयुक्त हस्तक्षेप हैं जो मौजूदा योजनाओं और कार्यक्रमों के माध्यम से सरकार और सार्वजनिक क्षेत्र के लोगों का ध्यान आकर्षित करेंगे।

गांव-वार सब्जी काश्तकारों के व्यापक डेटा बेस रिपॉजिटरी के विकास और डिजिटलीकरण तथा बीज / रोपाई, फसल के पालन के साथ-साथ मार्केटिंग के तरीकों तक पहुँच की आवश्यकता है। डिजिटल इंडिया के इस युग में जब कृषि समुदाय इंटरनेट की संभावनाओं के बारे में अधिक जागरूक हो रहा है, प्रत्येक किसान को आसानी से सभी जानकारी प्राप्त होना चाहिए। यह अत्यंत लाभकारी होगा यदि कीटनाशक विषाक्तता पर जिला स्तर के डेटा जैसे

- कीटनाशकों के बारे में सभी जानकारी, कीटों के हमलों और प्रकोप, कीटनाशकों के उपयोग पर जिला स्तर का डेटा, कीटनाशकों के विषाक्तता और प्रभावकारिता से संबंधित अध्ययन, कीटनाशक अवशेष, कीटनाशकों के पर्यावरणीय प्रभाव, कीटनाशकों पर अलर्ट आदि को उचित रूप से तैयार किया जाए और किसानों और गैर-किसानों को उपलब्ध कराया जाए।

टमाटर वायरस प्रबंधन में एंटीबायोटिक्स और फफूंदनाशकों के गलत उपयोग को रोका जाना चाहिए। ऐसी सब्जियों के उपभोक्ता विभिन्न रोगों के लिए उपचार करते समय एंटीबायोटिक प्रतिरोध का सामना करने के लिए उत्तरदायी होते हैं। किसानों को ध्यान रखना चाहिए, कि कोई भी एंटी वायरल रसायन उपलब्ध नहीं है। कीट-वेक्टर प्रबंधन लेबल के लिए दावा किया जाता है कि कीटनाशकों का केवल उपयोग किया जाना है। कुछ कीटनाशकों के वर्तमान प्रस्तावित प्रतिबंध हेतु वैकल्पिक विकल्प किसानों को उपलब्ध कराया जाना चाहिए।

- उत्पादकों को अपने सभी प्रयासों में आत्मनिर्भर होना चाहिए, जिसके लिए सभी हितधारकों को काम करना चाहिए, जिससे सच्चा **आत्म-निर्भर भारत बन सके।**

पौधों के स्वास्थ्य (2020) के इस अंतर्राष्ट्रीय वर्ष में सब्जियों सहित सभी फसलों में अधिक से अधिक स्वच्छ और हरित प्रौद्योगिकियों को एकीकृत करते हुए अच्छी कृषि पद्धतियों (जीएपी) को अपनाने का प्रयास करते हैं। इस सम्मेलन में हर राज्य के सभी किसानों से पर्यावरण-सुरक्षित स्वस्थ सब्जी फसलों को उगाने की अपील की गई। किसानों को वैज्ञानिक तरीकों के बारे में पता होना चाहिए और वैज्ञानिक खेती प्रौद्योगिकियों को स्थायी तरीके से उचित अनुसंधान और स्थानीय स्थिति की जरूरतों पर आधारित होना चाहिए।



Web Conference Recommendations

English

The concluded conference centered on the theme “**Vegetable Farmers Forum: Post Lockdown with Particular Emphasis on Plant Protection**”.

The Web Conference was graced by more than 800 participants, directly on Zoom platform and in the YouTube Live streaming. There were 17 lead talks, many contributory e-Oral and e-Poster presentations, Virtual Visits, Cultural-cum-motivational programme by children, Plenary session and Award ceremony. Participants were from various parts of the country, covering at least 17 states – AP, Assam, Bihar, Delhi, Gujrat, HP, J&K, Kerala, Karnataka, Maharashtra, MP, Odisha, Rajasthan, Tamil Nadu, Telangana, UP, WB etc. This is the first National web conference in IARI, and most probably also in entire ICAR.

The Forum through this Web Conference recommends few points to be pondered by all stakeholders, especially the policy thinkers and the public as well.

- Presently, research efforts by scientists and the knowledge of subject matter specialists including the extension agencies across the country are focused on sustainable and profitable vegetable farming. The issues are more intense, as the environmental safety and human health are at stake in addition to marketing and post-harvest processes. Crop husbandry including cultivating healthy vegetable crops needs coherent handholding of the knowledge banks with growers.
- The recently amended Essential Commodity Act (ECA-1955) removed vegetable commodities like onion and potato from the list of essential commodities; but these are essential items in our daily food basket and dishes. The bumper harvests of these agri-commodities often bring in unreasonably low market price. The farmers are made to lose even the cost of production of these commodities season after season. The poor farm infrastructure and cold storage facilities reduce the holding capacity of farmers and trigger the lowering price for perishable vegetable commodities due to distress sale. In this context, the post-harvest management of such commodities with primary and secondary processing at or near farm gates is to be established. Micro, Small and Medium Enterprises (MSMEs) should be encouraged with appropriate incentives to involve with vegetable farming groups (VFGs) in every district to see that there is regular unhindered market for them. In fact if MSMEs can enter into contract vegetable production, there shall be symbiotic benefits that would alter the scale of operation. End-to-end vegetable production from „seed to market“ is to be aimed through MSME platforms.
- The web-conference strongly recommend encouraging better public-perception and effective public-private-partnership in increased hand holding of vegetable farmer groups and MSMEs for processing and marketing of farm gate commodities. We tried our best to inculcate the culture of **Public-Private Partnership** in true sense and spirit.

- **Cloud-service centric approach will cater our NEED**

In Digital dictionary, the term cloud computing is quite popular, same style we need to concentrate our resources, intellectual and financial; tangible and intangible ingredients – all in an integrated approach. Piece-meal approach won't work; and **clouding thus, will release** our pressure on our limited recourse crunch.

- ✓ The web-conference apprehend a paradigm shift in the pest scenario due to country-wide cultivation of pest susceptible hybrid seeds from Private seed companies (>90%) in major vegetable crops like tomato. Introduction of new virus and other pathogens, and also insect-pests are the potential dangers to be anticipated.
- ✓ It is proposed that vegetable cultivation should be taken up in farms with 0.8 and above percentage level of soil organic carbon including in polyhouses/ green houses. The pest load management can be well-regulated due to this agro-ecology. Methods to improve soil organic carbon of soils in farms need to be propagated and adopted.
- ✓ There is dire need for planned survey and careful surveillance of such situations, follow-up monitoring through national and state research funding. One major way of doing this is maintaining a strict surveillance of direct insect as well non-insect pests including nematodes, indirectly for plant disease vectors, viz. sap-sucking insects (aphids, whiteflies, thrips etc). The 3R's (resistance, resurgence and residue aspects) – are to be monitored carefully.
- ✓ Pesticide-residue problems being more important in veggies (particularly in salad crops), proper care and caution must be followed by farmers. Regular intervention, monitoring by means of residue detection, in vegetables samples from common marketplace, must be given priority.
- ✓ The cultivation practice is continually changing in India, particularly in vegetable belts like Maharashtra, where more and more areas are now under protected or greenhouse condition, with frequent and indiscriminate pesticides use. International trade and travel have compounded the vector problem, with new species and strains emerging in the area.
- ✓ In the face of price crash at *mandis* and export limitations due to the nationwide lockdown, it dealt a double blow to the farmers. Supply-chain, the bank loan system is to be reviewed in the context of Cloud-centric Approach. Mere prevalent 7000 *mandis*, against the requisite 42,000 *mandis* in country, draws our attention to request government, for paying due attention in strengthening the infrastructure, storage facilities, transportation and marketing strategies, in large scale reaching the grass-root level. Amended ECA-1955, should go in favour of farmers, not middle-men; essentially suitable mechanism must be made earnestly.
- ✓ Right now, there is little collaborative endeavors in governmental agencies like ICAR, and SAUs with the major private players like Mother Dairy, F&V supply chain system in India. A cloud centric approach will even release pressure on government establishment, for market-driven research needs and funding, following the corporate social funding research (CSF) *modus operandi*.
- ✓ Progressive approaches like Cooperative organic farming groups, Vegetable Producer Groups, Self Help Groups, Nutri-gardens in rural villages for self-reliance, Subscription farming – are suitable interventions that shall receive due attention of government and public sector agencies through existing schemes and programmes.
- ✓ Digitalization and development of comprehensive data base repository of the village-wise vegetable cultivators and their access to seeds / seedlings, crop husbandry practices as well as marketing methods is needed. Every farmer, in turn, should get information at their fingertips, in this era of digital India, when farming community is becoming more aware of possibilities of internet, it will be well benefiting if all the information regarding pesticides like district level data on pesticide poisoning, pest attacks and outbreaks, district level data on usage of pesticides, studies related to

toxicity and efficacy of pesticides, pesticide residues, environmental impact of pesticides, alerts on spurious pesticides etc. are furnished properly and made available to farmers and non-farmers, sources in the country including reliable on-line suppliers to access pheromones and traps, light traps and other pest suppression gadgets.

- ✓ Rampant misguided use of antibiotics and fungicides must be stopped in tomato virus management. Consumers of such vegetable are liable to face antibiotic resistance while treating for various diseases. Farmers should keep in mind, that no anti-viral chemicals are available. For insect-vector management label claimed pesticides are only to be used. Alternate options must be made available to the farmers, in the face of current proposed ban of few pesticides.
- ✓ Farmers must be self-sufficient, self-reliant in all their endeavors, for which all stakeholders should work, making a true ***Aatma-nirbhara Bharat***.

In this *International Year of Plant Health (2020)*, let's strive for adopting Good Agricultural Practices (GAPs), integrating more and more clean and green technologies in all crops, including vegetables. The conference appeals to all farmers of every state to take up environment-secure healthy vegetable crops. Farmers should be aware of scientific practices, and the scientific cultivation technologies must be based on appropriate research based facts, suiting our local condition, in sustainable manner.



Jai Kisan, Jai Vigyan, Jai Anusandhan.

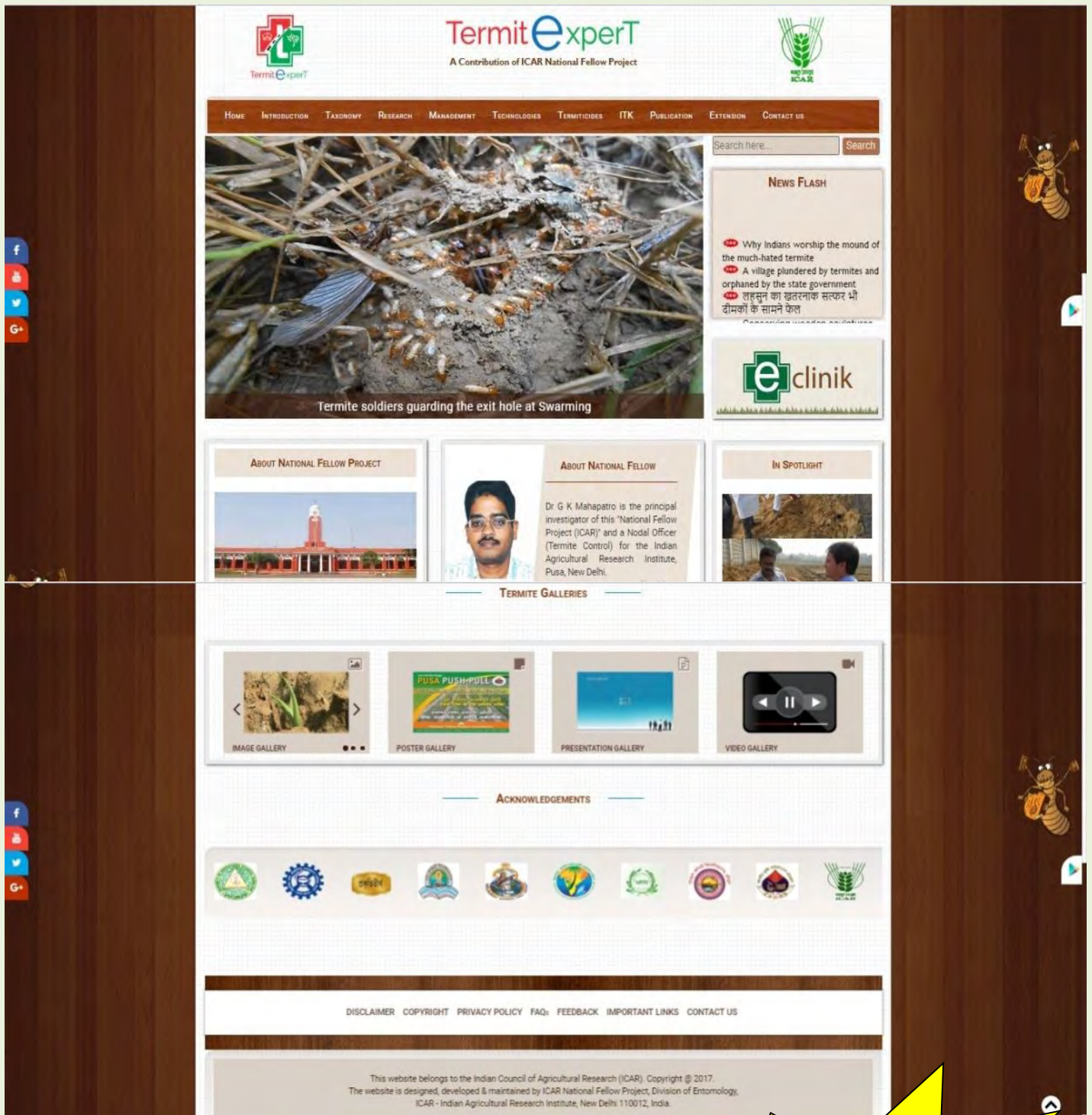
These Recommendations were published Online, dated 3rd July 2020

SMART AGRI POST
Empowering agripreneurs...

Termite Web-portal for Farmers

A Contribution of National Fellow Project

Vegetable farmers can plug on to this portal, and get information on termite integrated management.



More than
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प्रौद्योगिकी किसान मार्गदर्शिका

पूसा आकर्षण-प्रत्याकर्षण पद्धति द्वारा गेहूँ-मक्का प्रणाली में दीमक का प्रबंधन



पूसा आकर्षण-प्रत्याकर्षण पद्धति दीमक दमन का एक अभिनव तरीका

स्वच्छ तथा स्वस्थ खेती एक समुचित व सरल तकनीक

हमारे देश के कई हिस्सों में गेहूँ व मक्का की फसलों के लिए दीमक एक गम्भीर समस्या बनती जा रही है। अतः यहाँ पर गेहूँ व मक्का फसलों में दीमक से होने वाले नुकसान के नियंत्रण के लिए एक प्रभावी व पर्यावरण उपयोगी प्रौद्योगिकी प्रस्तुत की गई है।

आकर्षण-प्रत्याकर्षण रणनीति भारतीय कृषि अनुसंधान संस्थान नई दिल्ली की एक नई फसल संरक्षण प्रणाली है। इस पद्धति को पूसा संस्थान में लगातार तीन वर्षों से सफलता पूर्वक प्रदर्शित किया गया है। इस पद्धति के अनुसार दो मक्का फसल अवशेषों की कतार के बीच तीन कतार रसायनिक उपचारित गेहूँ की बोई जाती है (मक्का की दो कतारों की बीच की दूरी 75 सेन्टीमीटर) मक्का फसल के अवशेष दीमक को अपनी तरफ आकर्षित करते हैं। दीमक इनमें एकत्रित रह कर गेहूँ की फसल के पकने तक सूखी सामग्री को खाती रहती है। जिस कीटनाशक से गेहूँ के बीजों को उपचारित किया जाता है वह फसल को चूसने वाले कीटों से भी सुरक्षा प्रदान करता है व इसकी विकर्षक क्रिया दीमक को जड़ों से भी दूर करती है।

यह पर्यावरण उपयोगी तकनीक भारत सरकार की **“प्रत्येक बूंद पर अधिक फसल”** **“सामूहिक बीज उपचार अभियान”** नीतियों के अनुरूप है।

हर बीज को सुरक्षा का टीका

जैसे की हर बच्चे को पोलियो का टीका

कृषि मंत्रालय, भारत सरकार, नई दिल्ली

बीज उपचार के लिये कीटनाशक	मात्रा मिलीग्राम प्रति किलोग्राम बीज	
	गेहूँ	मक्का
इमीडाक्लोप्रिड	3	3
क्लोरोपाईरीफास	4*	—
फिप्रोनिल	4	5

कुछ जाँच की गई गेहूँ की किस्में :- डी. पी. डब्ल्यू-621-50, एच. डी. 2643 (गंगा), एच. डी. 2987 (पूसा बहार), एच. डी. 2985 (पूसा बसन्त), पी. बी. डब्ल्यू-550, पी. बी. डब्ल्यू-590, *एच. डी. 2967 (2 मिलीलीटर प्रति किलोग्राम बीज) व मक्का की किस्म :- एच.क्यू.पी.एम.-1

आकर्षण-प्रत्याकर्षण पद्धति

प्रथम मौसम-(खरीफ, मक्का)

चरण 1 : खेत की तैयारी

- खेत की बुवाई से पहले शुष्क अवधि में खरपतवार की अच्छे तरीके से सफाई करनी चाहिए।
- वर्षा ऋतु से पहले भूमि की जुताई करके मिट्टी को महीन करना चाहिए।
- आकर्षण-प्रत्याकर्षण तरीके से मक्का की बुवाई में दो कतारों की दूरी 75 सेन्टीमीटर होनी चाहिए।



मक्का फसल के अवशेषों के बीच की भूमि को समतल करना।

चरण 2 : मक्का का रोपण

- मक्का के बीजों को इमीडाक्लोप्रिड कीटनाशक की 3.0 मिलीलीटर प्रति एक किलोग्राम की मात्रा से उपचार करके बुवाई करनी चाहिए।
- मक्का की खेती के लिए मानक अभ्यासों का पालन करें।
- मक्का के दो कतारों के बीच की दूरी 75 सेन्टीमीटर और पौधे से पौधे की उचित दूरी होनी चाहिए।

चरण 3 : परिपक्वता के समय फसलों की दीमक से सुरक्षा

- जिन क्षेत्रों में दीमक का फसलों पर भारी संक्रमण हो उनमें कटाई करने से एक महीना पहले इमीडाक्लोप्रिड 0.5 मिलीग्राम प्रतिलीटर पानी से मक्का की जड़ों में छिड़काव करना चाहिए। या
- दानेदार फिप्रोनिल (रीजेन्ट) 0.3 जी 25 किलोग्राम प्रति हेक्टेयर में बुरकाव किया जा सकता है।
- मक्का की कटाई 4 या 5 सेन्टीमीटर (जड़ का हिस्सा) छोड़कर करनी चाहिए।



राष्ट्रीय अध्येता परियोजना,
भारतीय कृषि अनुसंधान परिषद्
कीट विज्ञान संभाग, भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली-110012



प्रौद्योगिकी किसान मार्गदर्शिका

द्वितीय मौसम (रबी-गेहूँ) की बुवाई

चरण 1 :

भूमि की तैयारी और गेहूँ की बुवाई

- मक्का की कतारों के बीच की कम से कम जुताई करें।
- गेहूँ की बुवाई के लिए मक्का की कतारों के बीच के क्षेत्र को समतल करें।
- मक्का की दो कतारों के बीच में पहले से उपचारित गेहूँ की तीन कतार की बुवाई करें।
- आकर्षण-प्रत्याकर्षण प्रयोग के लिए तैयार भूमि में गेहूँ की फसल को दीमक से बचाने के लिए बीजोपचार किया जाए जोकि अन्य चूसक कीटों जैसे माहू का भी ध्यान रखता है।



मक्का फसल के अवशेष/खूटी/जड़ दीमक को आकर्षित करते हैं, दीमक एकत्रित होती है और चींटियों को आमंत्रित करती है, इस प्रकार कीटों का प्राकृतिक नियंत्रण भी होता है।



दीमक मक्का के अवशेषों/खूटीयों को विघटित करके मिट्टी की उर्वरता को बढ़ाती हैं।



तकनीकी सहयोग :

एन.वी. कुम्भारे, गणेश राय, सचिन कुमार एवं मोनिका सिंह

अधिक जानकारी के लिए सम्पर्क करें:-

जी. के. महापात्र ई-मेल : gagan_gk@rediffmail.com

चरण 2

- गेहूँ की कटाई के बाद, पूरे खेत की अगली फसल के लिए जुताई की जा सकती है।
- अगर किसान जैव कीटनाशकों का प्रयोग करना चाहते हैं तो, जैव कीटनाशकों को फसल अवशेषों में प्रयोग करना चाहिए जहाँ दीमक सूखी फसल के अवशेषों को नष्ट करती है। इस विकल्प से जैव कीटनाशकों के प्रभाव को भी बढ़ाया जा सकता है:- सूत्रकूर्मि (निमेटोड) या रोगजनक कवक (बियोवेरिया बासीयाना, मैटाराइजियम इनाइसोफिली और इसटरनेमा थग्रोफाईलम)।



नुकसान का लक्षण-दीमक से ग्रसित गेहूँ के पौधों को आसानी से उखाड़ा जा सकता है।

पूसा आकर्षण-प्रत्याकर्षण पद्धति: मुख्य लाभ

- इस पद्धति में सिर्फ बीजोपचार के लिए लागत आती है।
- समुचित जल प्रबंधन, "हर बूँद पर अधिक फसल" के सिद्धांत का पालन करता है।
- भूमि की जुताई पर होने वाली लागत बचती है।
- बहु-कीट-स्थिति की जरूरत को पूरा करता है- बीज उपचार ना केवल दीमक के लिए विशिष्ट है, यह प्रारंभिक चरण में फसलों को प्रभावित करने वाले कीटों से भी सुरक्षा प्रदान करता है।
- हॉलाकि यह पर्यावरण उपयोगी तकनीकी छोटे किसानों के लिए है पर इसको बड़े किसानों के लिए भी अपनाया जा सकता है।



राष्ट्रीय अध्येता परियोजना,
भारतीय कृषि अनुसंधान परिषद्
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SIGNIFICANT CONTRIBUTIONS ICAR - IARI REGIONAL STATION, PUNE

Pioneer Institute of India on Plant Virus Diseases - established in 1938 (as Plant Virus Research Laboratory) by Imperial Council of Agricultural Research, British India; the objective being coordinating all research works on virus diseases of plants of this region and country. Considering its national importance, the station was transferred to Indian Agricultural Research Institute (IARI), New Delhi on 1 April, 1956; and renamed as IARI Regional Station, Pune. Office and laboratories of the station were shifted from Shivaji Nagar campus, to its 18 acre experimental farm at Aundh, Pune on 16 February, 2014.

The station is the only one of its kind engaged exclusively in research and extension on virus and virus like diseases of fruits and vegetables. The station has characterized many viral diseases and developed their diagnostic & management practices. Many first reports of virus diseases (**at least two dozens of crops**) and insect vectors are from this station only, namely, **bottle gourd** virescence & phyllody (2017), mixed infection of *Papaya ringspot virus* (PRSV) and phytoplasma in **papaya** (2016), axillary shoot proliferation phytoplasma disease in **papaya** (2014), *Zucchini yellow mosaic virus*, on **zucchini, bottle gourd, muskmelon and cucumber** (2003-2006), *Watermelon bud necrosis* caused by *Tospovirus* in **muskmelon** (2004), *Pepper veinal mottle virus* and *Tobacco etch virus* in **capsicum** (2004), Yellow mid-vein of citrus in **Kagzi lime** (1981), Mosaic disease of **Sawa** (*Panicum crusgalli*) and *Rhopalosiphum maidis* and *Myzus persicae* as vectors (1977), Little leaf syndrome in *Justicia jendarussa* (1976), Exocortis disease of **citrus** (1975), small leaf stenosis disease (caused by MLO) of **cotton** (1972), mosaic disease on **yam** and *Myzus persicae* and *Aphis gossypi* as vectors (1969), Chlorosis disease of **sorghum** and delphacid (*Peregrinus maidis*) as its vector (1968), Citrus psyllid, *Diaphornia* as a vector of Citrus Greening (1967), Broken stripe disease in **corn** and its leaf hopper vector (1966), Yellow mosaic disease of wild **jute** (1966), Mosaic disease of **finger millet** and its 7 aphid-vector species (1965), Stripe disease of **maize** (1965), Little leaf of **brinjal** on *Datura fastuosa* & *Catharanthus roseus* (1965), *Elettaria cardamom* and *Amomum* species as additional hosts for footrot disease of **large cardamom** (1964), Mosaic disease of southern **sunhemp** (1962), **Chilli** leaf curl disease in **brinjal** and **tomato** (1959), *Pentalonia nigronervosa* as vector of „kutte“ disease of **small cardamom** (1958), Yellow vein mosaic of **okra**: whitefly as vector and *Hibiscus tetraphyllus* as collateral host (1950), **Sugarcane** grassy shoot disease caused by MLO: aphids as vector and sorghum as an additional host (1949), PRSV disease (1947-48), **Chilli** mosaic disease (1940); etc.

Latest Significant Contributions

- Complete genome of Papaya ringspot virus of Pune isolate; molecular characterization of CP gene sequences of PRSV from Maharashtra and Gujarat, virus occurrence mapping of India.
- Integrated virus management module for PRSV in papaya, vegetables (tomato, chilli, cucumber, muskmelon and capsicum, okra; first report of an invasive pest, tomato pin worm/leaf miner *Tuta absoluta*.
- Unique in entire country - PRSV tolerant papaya lines (PS-1 & PS-3), registered with National Germplasm registration Committee (ICAR).
- Conducted the Workshop on *Safe Use of Pesticides*, in Jan 2018. Around 450 participants attended – farmers, pesticide dealers, students, scholars, scientists and other stakeholders.
- Formation of **Vegetable Farmers Forum** (20-April 2020) during covid-19 lockdown.
- Verifying the truth behind *Tiranga* virus in tomato in May-June 2020.
- Termite web-portal (www.termitexpert.in) reached >3.6 lakh hits/visits by June 2020 (web-launched in 2017, National Fellow Project ICAR).

Even, once in past, this station was mooted/ proposed to be a separate full-fledged National Institute considering its national importance in plant protection sector.

Lead and Key Speakers of the National Web Conference 2020



Chandish R Ballal



GK Mahapatro



Pravash Pradhan



DP Abrol



Sanjiv Layek



Anju Kamra



Kaushik B



Debashis M



Kolla Sreedevi



Vinay Kalia



Vikash Jha



Sreekant Sharma



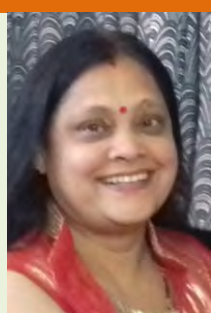
Mihir M



JP Singh



Gavash R



Madhumita



Sudhakar



Rajna



Nikhil Raj



Mohit

Conference Voluntary Workers

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