



Institutionalising COVID Period Innovations in Agricultural Marketing



Editors

Dr. P. Chandra Shekara
Dr. V. K. Jayaraghavendra Rao
Manoj Kumar Agrawal

Chaudhary Charan Singh National Institute of Agricultural Marketing (CCS NIAM)
(An Autonomous Organisation of Ministry of Agriculture and Farmers Welfare, Government of India)
Jaipur, Rajasthan | www.ccsniam.gov.in

Institutionalising COVID Period Innovations in Agricultural Marketing

Editors

Dr. P.Chandra Shekara

Dr. V.K. Jayaraghavendra Rao

Manoj Kumar Agrawal

July, 2020



CCS National Institute of Agricultural Marketing

(An Autonomous Organization of Ministry of Agriculture and Farmers Welfare, GoI)

Bambala, Tonk Road, Jaipur-302033, Rajasthan.

www.ccsniam.gov.in

Institutionalising COVID Period Innovations in Agricultural Marketing

@2020, CCS NIAM

Editors

Dr. P.Chandra Shekara

Dr. V.K. Jayaraghavendra Rao

Manoj Kumar Agrawal

ISBN: 978-81-943252-4-6

Printed at:

Premier Printing Press, 12, Ram Nagar, Jaipur (Raj.)

Published by :

CCS National Institute of Agricultural Marketing

(An Autonomous Organization of Ministry of Agriculture and Farmers Welfare, GoI)

Bambala, Tonk Road, Jaipur-302033, Rajasthan, India.

Phone No. : 0141 277 0027

Website: www.ccsniam.gov.in

Foreword

Sanjay Agarwal
Secretary, DAC&FW



सत्यमेव जयते



भारत सरकार
कृषि एवं किसान कल्याण मंत्रालय
कृषि सहकारिता एवं किसान कल्याण विभाग
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation
& Farmers Welfare

FOREWORD

Agricultural Market has moved to Farm Gate through Historic Reforms in Agricultural Policy on Agricultural Marketing. Conducive eco-system has been created by promotion of Farmers Producers Organizations (FPOs) by Ministry of Agriculture and Farmers' Welfare, Govt. of India. Boost to Agricultural infrastructure is going to benefit FPOs and facilitate a strong linkage with Agri-Business stakeholders. We need more and more Innovations in Agricultural Marketing to benefit farmers in this free trade eco-system which we can institutionalize for larger benefit of farmers subsequently.

I am happy to note that CCS NIAM has completed series of 55 webinars covering 7,200 stakeholders during COVID lockdown period on Agricultural Marketing Innovations and Agri-Startups meant for institutionalization. These webinars are also placed in CCS NIAM's Youtube channel. These innovations adopted at the level of individual farmers, institutions and States need to be institutionalized for the benefit of the farmers across the country. This publication aims at creating awareness about such Agricultural Marketing Innovations tried during COVID period in different parts of the country.

I would like to compliment the efforts of Director General, CCS NIAM and his team for effectively utilizing the COVID lockdown period for webinar series and coming out with useful publication for the benefit of farming community on Agricultural Marketing which is need of the hour. I hope the publication will benefit all the stakeholders in Agricultural Development.

Best wishes,


(Sanjay Agarwal)

Preface

डॉ. पी. चन्द्र शेखरा
महानिदेशक



Dr. P. Chandra Shekara
Director General



PREFACE

“Anything can wait but not Agriculture”.

COVID-19 lockdown brought the life stand still, but Agriculture continued with same vigorous performance with record highest production. Thanks to all the farmers and stakeholders for ensuring National Food Security during COVID lockdown period.

It was testing time for CCS NIAM as social distancing and prohibition on travel halted all the Capacity Building activities. But, CCS NIAM followed the principle path **“Let us not waste the crisis”**. During lockdown period, CCS NIAM organized 55 webinars and 15 on-line training programmes on **“Innovations in Agricultural Marketing during COVID-19 period”** and **“Agri-Startups”**. This approach went very well during lockdown period covering 7,200 stakeholders spread across the country that too with zero cost.

The bigger challenge was to recognize the innovations emerged in Agricultural Marketing during COVID-19 period and institutionalizing the same so that innovations are mainstreamed in the system for sustainability. The purpose of this publication is to institutionalizing the innovations in Agricultural Marketing during COVID period for the benefit of all the stakeholders in Agricultural Development.

It was a great teamwork of National Facilitators of CCS NIAM, Agri-Startups promoted by CCS NIAM and faculty and staff of CCS NIAM in most difficult lockdown period.

I am sure the publication will benefit all the innovators, institutions and systems to absorb all the innovations and use for providing value added services to farmers for enhancing their income.


(Dr. P. Chandra Shekara)

Message

The rationale of the webinar AGRICULTURAL MARKETING IN COVID19 PERIOD arising out of the global pandemic, the public and private, professional and business operations in primary, secondary and tertiary sectors are halted. In order to mitigate and develop alternate strategies for rejuvenating broken supply chains, reconstruct broken homes and livelihoods, the webinar jointly organized by CCSNIAM, ICAR-IIHR and a couple of institutions, have struck the right chord, to converge and dovetail the efforts of academicians and relevant stake holders to come out with an alternate strategy to get the business going.

During COVID lockdown issues like Marketing of Fruits and Vegetables, FPOs role in Agricultural Marketing, Good Practices in Agricultural Marketing, Project approach for startups, Economic analysis of farmers group, Potential of Micro and Mobile Retail Marketing of Agricultural Produces using vending mobile vans developed by IIHR, creating Alternative Marketing Systems for farmers, goes a long way in marketing low fertilizer zero chemical use organic produce. Use of ICT social media, B2B, C2B, P2C and C2P marketing models were seen during the period. This has led to Innovations and good practices in marketing of fruits and vegetables. E-Commerce through digitizing and networking using social and unconventional media reach has thrown many challenges and opportunities too. The Role of Government sector through Atmanirbhar package for welfare of farming community and economically marginalized sections are also discussed in this webinar, thereby making entrepreneurs and small producers to move in the direction of Direct Marketing reducing the role of middlemen has emerged as an innovation of sort. Further Unconventional strategies for reaching customers during lockdown period goes a long way in up scaling and institutionalizing these market innovations as a catastrophe and disaster management strategy.

The webinar deserves all accolades and success and the recommendations of the webinar is intended to reach the stake holders for a contingency model of marketing without jeopardizing the efficiency of either the supply or value chains.

Place: Bengaluru

(M.R DINESH)

Date: 30th April, 2020

Director ICAR IIHR

Contents

Sl. No.	Articles	Page No.
1.	Innovations and Good Practices for Marketing of Fruits and Vegetables during COVID19 <i>T.M. Gajanana</i>	1-9
2.	Good practices in Agricultural Wholesale Markets: Answer to COVID19 Challenges <i>Anil Chauhan</i>	11-18
3.	Unconventional Strategies for reaching Customers during Lockdown Period <i>V K. Jayaraghavendra Rao</i>	19-23
4.	Use of ICT in Agricultural Marketing <i>P. Murali and D. Puthira Prathap</i>	25-36
5.	Maize: Crop And Post-Harvest Management During COVID19 Situation <i>M. C.Dagla, Pardeep Kumar, Bharat Bhushan, Ramesh Kumar and S. B. Singh</i>	37-46
6.	Do's and Don'ts for the farmers in COVID period <i>Roshan Lal Meena</i>	47-59
7.	Linking Farmers to Market : Marketing of Perishable Commodities during lockdown period <i>B. S. Reddy and G.M.Hiremath</i>	61-70
8.	Fisheries Marketing in COVID Period: Innovations & Good Practices <i>B. Ganesh Kumar</i>	71-75
9.	Government Programmes for welfare of farming community during COVID19 <i>Ashok Kumar</i>	77-86
10.	Direct Marketing in Agriculture: Emerging innovations in COVID Period for Fruits and Vegetables <i>H.M. Hiremath and B. S. Reddy</i>	87-96
11.	Green Fodder Conservation and Marketing as Enriched Animal Diet in the Lock Down Period of COVID19 <i>Prabha Kant Pathak, Prakash Narayan Dwivedi, Sanjay Kumar Singh, Chandra Shekhar Sahay, Amit Kumar Patil and Bholuram Gurjar</i>	97-104
12.	Crop Management and Hybrid Seed Production Activities in Rabi Maize : Harvest to Marketing during COVID19 Lockdown <i>Shyam Bir Singh</i>	105-117

Innovations and Good Practices for Marketing of Fruits and Vegetables during COVID19

T.M. Gajanana

ICAR-IIHR, Hesaraghatta Lake Post, Bengaluru-560 089, Email: gajanana.tm@icar.gov.in

Introduction

The Corona COVID19 created havoc and logistics, labour availability for agricultural operations were disturbed and it disrupted the supply chains of agricultural and horticultural commodities all over the country. The perishables like fruits and vegetables were the most affected during this COVID19 crisis. Necessity being the mother of invention, farmers, farmer groups, institutions rose to the occasion and innovated themselves to tide over the crisis. Against this background, an attempt is made to analyse the innovations and adjustment mechanisms made by the ones who are affected by the present disturbances.

Fruit and vegetable production

In COVID19, Institutionalization of Direct marketing, Innovative Farmers' markets emerged through E-trading especially through eNAM platform. Network chain of FPOs has strengthened. ICAR-IIHR designed solar powered F&V vending van, tomato crush value added products, high humidity chamber, low cost ripening technologies which will penetrate in to different states and gain momentum in the post COVID19 situation.

India has been experiencing a healthier growth in horticulture with a production of 311.71 million tons from 25.43 million ha (2017-18), surpassing the annual production of food grains. Over the last one and a half decade, horticultural production has been growing at a rate of around 6 percent. Being the second largest producer of fruits and vegetables in the world, these account for over 90 per cent of the total horticultural crop production.

Table 1: Fruit and vegetable production

Year	Fruit production ('000 tons)	Vegetable production ('000 tons)	Total F&V production ('000 tons)
TE 1993-94	32947.33	62708.33	95655.66
TE 1999-2000	44266.67	83680.67	127947.34
TE 2007-08	60388.17	116989.93	177378.10
TE 2013-14	82228.67	160469.70	242698.30
TE 2017-18	93456.33	177210.00	270696.33
CGR (%)	6.25	6.11	6.16

In order to absorb the surplus generated due to technological interventions-varieties, production/protection technologies, IDM/IPM/INM etc, concurrent improvements were also being made in the field of marketing and supply chain management. Innovative markets have been emerging for catering to the needs of farmers of horticultural crops. Some such innovations are listed below.

Innovations in horticulture markets:

Model Market Act, 2003, APLM Act, 2017: Salient features of APLM Act, 2017-

- (i) Abolition of fragmentation of market within the State/Union Territory (UT) by removing the concept of 'notified market area' in so far as enforcement of regulation by Agricultural Produce and Livestock Market Committee (APLMC) is concerned. In other words, the APLM Act provides for the recognition of a State/UT as a single market.
- (ii) Besides cereals, pulses and oilseeds, the Act seeks to provide for geographically restriction-free trade transaction of agricultural produce including commercial crops like cotton, horticultural crops, livestock, fisheries and poultry.
- (iii) Disintermediation of food supply chain by integration of farmers, processors, exporters, bulk retailers and consumers
- (iv) The clear demarcation of the powers and functions between the Director of Agricultural Marketing and Managing Director of State/UT Agricultural Marketing Board with the objective that the former will have to largely carry out regulatory functions, while the latter will be mandated with developmental responsibilities under the Act.
- (v) Creation of a conducive environment for setting up and operating private wholesale market yards and farmer-consumer market yards, so as to enhance competition among different markets.
- (vi) Promotion of direct interface between farmers and processors/exporters/bulk-buyers/end users so as to reduce the price spread bringing advantage to both the producers and the consumers.
- (vii) Enabling declaration of warehouses/silos/cold storages and other structures/space as market sub-yard to provide better market access/ linkages to the farmers.
- (viii) Giving freedom to the agriculturalists to sell their produce to the buyers and at the place and time of their choice, to whomsoever and wherever they get better prices.
- (ix) Promotion of e-trading to enhance transparency in trade operations and integration of markets across geographies.
- (x) Provisions for single point levy of market fee across the State and unified single trading license to realize cost-effective transactions.
- (xi) Promotion of the national market for agriculture produce through provisioning of inter-state trading license, grading and standardization and quality certification.
- (xii) Rationalization of market fee and commission charges.
- (xiii) Provision for Special Commodity Market yard(s) and Market yard(s) of National Importance (MNI).
- (xiv) Full democratization of Market Committee and State/UT Marketing Board.

Distant market sale model

The very idea of distant market model is to take advantage of the higher price prevalent in the distant market. Hence, so long as the transportation and other marketing costs are lower than the price differential, it is advisable to choose the distant market over the local market. Sale of Bengaluru grown Pink flesh guava in Tamil Nadu and Kerala is a case in point.

Pink flesh guava in Tamil Nadu and Kerala: The guava growers should encash the higher price prevalent in Kochi (Kerala) and Chennai (Tamil Nadu) markets, which at present, is the domain of the PHCs.

Table 2: Marketing cost, price realized, intermediaries margin and producer's share in guava (Pink flesh) in distant markets (Rs/kg)

S.No.	Particulars	Kerala	Tamil Nadu
1	Selling price of PHC/Purchase price of Wholesaler	20.83	24.00
	Marketing cost of WS	2.88	2.75
	Margin of WS	6.21 (20.75%)	7.96 (22.91%)
	Selling price of WS/Purchase price of Retailer	29.92	34.71
	Marketing cost of Retailer	0.27	1.40
	Margin of Retailer	16.35 (35.13%)	30.42 (45.72%)
2	Selling price of Retailer /Consumer's price	46.54	66.53
3	PHC's /Producer's share (%)	44.76	36.07

Source: Gajanana, T.M., Sreenivasa Murthy, D., Sudha, M., Saxena, A.K., Sudhakar Rao, D.V. and Dakshinamoorthy, V. 2019. Post harvest loss and marketing of fruits – economic analysis of pink flesh guava in local and distant markets in India, Journal of Horticultural Sciences, 14(1):1-6

Similarly, we also have the following examples of distant market sale:

- 'Banana Special' train from Nimbhora in Raver taluk, Jalgaon in Maharashtra to Delhi
- Sale of Nagpur mandarins during 2016 in Bengaluru is another case of taking advantage of the higher price in the distant market – The orange growers realized Rs.25-30/kg in Bengaluru when the price was Rs.7-8/kg in Amravati. Even after meeting the transport and other expenses, they could realize a profit of around Rs. 8-10/kg.
- Recently, the grape growers of Maharashtra organized themselves to sell their grapes in different places like Delhi, Jaipur, Bengaluru etc. and could realize Rs.800 crore during this grape season.

Roadside/high way stalls for marketing of fruits and vegetables

Marketing of Indigenous mango – Roadside stalls:

Chittoor in Andhra Pradesh is known for mangoes and it also has the distinction of having

more than 40 indigenous varieties of mangoes. But there is no separate market for indigenous mangoes. These indigenous mangoes are normally brought to APMC along with other varieties. However, price realized in the APMC is less as it is treated like other varieties (Other than Choice varieties) because the value of indigenous varieties not yet popular: Early bearing, Late bearing, Good keeping quality; Multipurpose – Fresh, processing and pickle; High temperature tolerant and Ecosystem services offered by these varieties like improved pollination.

Table 3: Road side stall for marketing of Indigenous mangoes by Chittoor farmers(Rs/kg)

Indigenous varieties	Mandi	Stall	Difference
Kudadut	8.99	47.61	38.62
Naati	8.04	11.91	3.87
Reddy Pasand	6.14	7.61	1.47
Kalepadu	13.03	24.41	11.38
Green Baneshan	-	12.61	12.61
Atimadhuram	-	22.61	22.61
Dil Pasand	7.57	11.20	3.64

Source: Field survey of the custodian farmers

Emerging markets for safe and nutritious horticultural produce

Health and quality conscious consumers are now looking for safe and nutritious horticultural produce and in order to make available such produce, markets, though on a small scale, have emerged in the form of outlets for organic produce, fresh and dried horticultural produce markets, carbide free produce etc,. Era Organic, Phalada Agro Research Foundation, ISKON, Organic Junction are involved in production and marketing of organically grown commodities in their own retail outlets in metropolitan cities. International importers like the Netherlands based Eosta, Thailand based Swift are showing keen interest in organically grown fruits and vegetables.

FPO and Producer companies’ model of marketing

Some of the FPOs have been helping the farmers in getting higher prices for their produce. In fact, the recently formed The Palamaner Farmers’ Producer Company - Promoted by DHAN Foundation is procuring 5 t/day vegetables from farmers during COVID19 period. It has also linked itself with e Platform of APMC, Palamaner by obtaining eNAM license.

FPC facilitating road side market

The FPC, Shetkari Athwadi Bazar, Pune has established 24 weekly road side markets, 12 each in Pune and Mumbai. The sale of farmers’ produce (fruits and vegetables) in these road side markets is fetching 10-12% higher price compared to APMC.



Virtual market/e-marketing/Online marketing

E-NAM: Unified National Agriculture Market

APMC Act is restrictive regarding trading of produce within the state. But farmers selling their produce through auction in the local market (mandi). Trader needs a license to operate in a Mandi. Wholesalers, traders and food processing companies cannot buy the produce directly from the farmers and they have to go through the mandi. Hence, emphasis on creating a Unified Market that is well-integrated across the nation to increase the net returns of the farmer. A Central Sector Scheme was proposed by DAC through ATIF to be implemented by SFAC - 2015-2018 and establishment of E-Platform in 585 regulated wholesale markets (785 now). Intra-state reforms - a single license to be valid across the state, single-point market fee and electronic auction for price discovery were also proposed to be implemented.

The study on the performance of eNAM implementation in AP, indicated that though all the recommendations pertaining to eNAM are not practiced, the eNAM benefited the farmers who realized up to 32.21 per cent higher returns compared to non-eNAM farmers. This increased income to the eNAM farmers was mainly due to significant reduction in marketing cost.

Table 4: Benefits of eNAM to Farmers

Particulars	eNAM	Non-eNAM	% or
Cost of production (Rs./q)	632.02***	711.95	-11.22
Marketing cost (Rs./q)	136.07***	206.65	-34.15
Gross returns (Rs./ac)	221044.20*	204860.00	7.97
Price (Rs/q)	1302.67*	1221.50	6.65
Gross Margin (Rs/ac)	114051.67***	86265.86	32.21

*** significant @ 1%, ** @ 5% and * @ 10%

Gajanaana, T.M., Sreenivasa Murthy and Somanath, 2020. Emerging marketing models to link farmers to market-case of eNAM, submitted to ICAR-IIHR, Bengaluru

New initiatives (Innovations) by ICAR-IIHR

The ICAR-IIHR has been working for the past 50 years and developed technologies in the fields of crop improvement (varieties/HYVs), production and protection technologies, post harvest technologies etc. Given below is the gist of technologies (innovations) which became handy during the COVID19 crisis.

- Seed village concept for higher returns to the farmers - vegetable seeds with buy back arrangement.
- Solar powered Fruit and Vegetable Vending Van.
- End to end mechanization of onion crop - commercialized.
- Low cost ripening technology for mango, banana and other fruits.
- Technology for large scale ripening of fruits - Commercialized to Nandharis seeds, HOPCOMS.
- Tomato crush technology (substitute for fresh tomato) - commercialized to Sun Sip and FPOs for larger coverage of tomato farmers.
- High Humidity Chamber (Tricycle) for retail sale of leafy vegetables.
- Technology for preparation of onion paste.
- E-Horticulture - Whatsapp group - Farmers, Scientists, FPOs are members.
- Export promotion through protocol development.



Solar Powered Fruit and Vegetable Vending Van

Solar-powered vegetable vending vans come in handy during lockdown, The Hindu (dated 6.4.2020)

When people are living under lockdown in the wake of COVID19 threat, a solar-powered vegetable and fruit vending van designed by the ICAR-Indian Institute of Horticultural Research (IIHR) has come in handy for them to buy fresh vegetables near their houses in a few districts where such vans are deployed by the Horticulture Department. The van is designed

to keep vegetables and fruits not only dust-free and hygienic, but also fresh for two days with the evaporating cooling technology. The van designed in 2017-18. The van has facility to keep trays for storing vegetables, leafy vegetables and fruits with a cooling chamber. In the backside, it has a LED TV for displaying the prices of produce. The TV can also be used for disseminating social messages and crucial information to farmers on horticulture. An audio system too has been fitted to provide for announcements. An electronic weighing machine with computerized billing facility too has been provided. "Except for running the vehicle, all other systems on the vehicle such as its cooling chamber, TV and audio announcement system are operated by solar power. It also has a battery that can be charged for emergency usage. It is also GPS-enabled so that its whereabouts can be tracked,". So far, the IIHR has developed 20 such vans for operating in 10 districts "The idea is to link farmers and consumers directly through sales units. Presently, it is costing ₹11 to ₹12 lakh for putting all these features including the cost of van. But the cost is bound to reduce when mass produced, two such vans were pressed into service in Vijayapura in March 2020 and the new system evoked good response with all the produce being bought up within a few hours on the first day itself. And each van registered a business turnover of ₹14,000. Two such vans that are operating in Koppal in the last few days have got good response too with each reporting a daily business of about ₹18,000.

Tomato crush - IIHR initiative

Tomato crush is concentrated tomato pulp with seeds and peel which could be used as a substitute to fresh tomatoes (while preparing food, it can also be used as a raw material for processed tomato products such as sauce and ketchup). The crushed tomato is an intermediate product where inclusion of seed and peel adds to the consistency and colour of the product. Ready-to-use crushed tomato is rich in ascorbic acid (17.55mg/100g) and lycopene (5.65mg/100g). It is acidic and could be used as a substitute for fresh tomato for various culinary preparation. About 1000 kg of tomato can be converted in to 300 kg tomato crush. This technology is commercialized to AP based Sun Sip company and licensed to 6 FPOs. Farmers are linked to these processors.

Similarly, ICAR-IIHR also developed technologies for onion paste preparation. Onion can be converted in to paste and this can be used/sold when onion price rises. Many of the technologies are being disseminated to the stakeholders through a network of KVKs under different ATARIs. ICAR-IIHR also conducts frontline demonstrations of the technologies in the farmers' fields. Many technologies are also licensed to entrepreneurs and private companies for large scale availability of these technologies.

Direct linking of farmers to market

Farmers in association with UAS Alumni Association could sell about 300 tons of grapes in the residential complexes @ Rs.55-65/kg thereby realizing full value for their crop and also helping the consumers saving about Rs.25-35/kg if purchased from the market. Agri War Room at UAS, Bengaluru is also facilitating sale of mangoes in this season.

FPOs came to the rescue of the farmers during this distress situation and procured the fruits and vegetables from the farmers and arrange to sell in their premises.



Value addition activities by farmers/farm groups

During COVID19, when the price of tomato crashed to Rs.4-5/kg, the Koalr district farmers resorted to value addition by sun drying tomato to prepare the sundried tomato slices.

Sun drying of tomato in the absence of marketing facility for fresh tomato – SHG



NGOs supported the SHGs by encouraging them to prepare the Sundried tomato slices using solar panels for effective conversion of solar energy.





Farmers' market

Ayakudi in Dindigul district of Tamil Nadu specialized in growing of guava and this guava cultivation is market driven. Ayakudi fruit market is a 365 days market catering to farmers of guava and mango. Guava growers are realizing a minimum of Rs.30 /kg and this price goes up to Rs.70/kg depending upon the season and quality of guava being sold. Even during COVID19 period, the fruit market operated with social distancing and other Corona related recommendation.



Conclusions

- While, Model Market Act, 2003 and APLM act 2017 paved the way for creation of private markets and contract farming, the policy intervention to support FPO and formation of producer companies stand out which may make a dent in this direction.
- Institutionalization of Direct marketing and distant market sale crucial post COVID19.
- FPO/FPCs have an important role to play.
- More Farmers' markets will emerge.
- E-trading especially through eNAM platform with networked FPOs will be strengthened.
- ICAR-IIHR designed solar powered F&V vending van, tomato crush, will penetrate in to different states as technologies are most suitable.
- High humidity chamber, low cost ripening technologies gain momentum in the post COVID19 situation.

Good practices in Agricultural Wholesale Markets: Answer to COVID19 Challenges

Anil Chauhan, Secretary, Agricultural Produce Market Committee, Hamirpur (Dosarka), P.O. Mohin, Distt. & Teh. Hamirpur (H.P.), Email Id: anil.chauhan@gmail.com

Introduction

Novel Corona Virus 2019 (COVID19) has impacted the human race very badly than any other disease in twenty first century. Almost every country on this planet was affected by this virus. The condition is more severe in developed countries.

So, when it all started?

There were reports that the medical professionals of Wuhan in China informed the government that there is some mysterious pneumonia like disease which is spreading very fast and affected the doctors and other paramedical staff who are attending the patients. When the situation became serious it was declared as outbreak of epidemic and first case of COVID19 was declared in Wuhan China on 31st December 2019. Wuhan is one of the main business centres of china and there was regular movement of domestic and international visitors to that place. Till the problem was identified and communicated to other agencies, the spread of virus was already there in other parts of china and world specially Europe and USA.

During the lockdown process all the commercial establishments were closed and only essential services were operational. It was the duty of District Administration to fulfil the basic requirements of public like food grains, milk, vegetables, medicines etc. It was proposed that there should be minimum human touch with the consumable items. After some days the agricultural services were permitted to operate and permission to open the wholesale markets were granted. At this time the rabi crops were almost ready to harvest. Wheat which is a major rabi crop is ready to harvest and farmers were planning to arrange the resources for its post-harvest management. In Some hot areas harvesting was already done. Machinery and labour were the major resources which need to be mobilized during that period. Due to relaxation in lockdown norms there is partial movement of these two resources, which helped the harvesting process.

Although Central and State governments are taking all the possible steps to meet the challenges of COVID19 which will show its results in future. But immediate relief to farmers, labours and traders to restore livelihoods is the need of the hour. Efforts should be made to increase the real income of farmers. Facilitation should be given to trader so that the size of the value chain system can be increased, which will ultimately benefit every stakeholder and the economy as a whole.

In the 3rd advanced estimates of production by Ministry of Agriculture and farmers' welfare, there will be record production of crops in this year. As per 3rd Advance Estimates, the estimated production of major crops during 2019-20 is as under:

Food grains-

295.67 million tonnes. (record)

Rice - 117.94 million tonnes. (record)

Wheat - 107.18million tonnes. (record)

Nutri / Coarse Cereals -

47.54 million tonnes. (record)

Maize - 28.98 million tonnes. (record)

Pulses - 23.01 million tonnes.

Tur - 3.75 million tonnes.

Gram - 10.90 million tonnes.

Oilseeds -

33.50 million tonnes. (record)

Soybean - 12.24 million tonnes

Rapeseed and Mustard -8.70 million tonnes

Groundnut - 9.35 million tonnes

Cotton -

36.05 million bales (170 kg per bale) (record)

Jute & Mesta -

9.92 million bales (180 kg per bale)

Sugarcane -

358.14 million tonnes

Challenges in Marketing:

- **Availability of harvesting machinery and manpower**

India is a diverse country. Numbers of crops are grown at different times in different parts of country, which require movement of harvesting machinery and manpower to perform the harvesting operations. The migration of agricultural labour is very common. At the time of lockdown, the labour and machinery were at different location from production areas. Their movement was a great difficulty during this time.

- **Hassel free movement of vehicles across the district and state boundaries**

Some specific states or district have become epicentre of COVID19 infections like Delhi and Mumbai. The movement of labour and vehicles to North and South India are through these major cities as these are the transport junctions. Due to outbreak of COVID19 the state and district authorities has stopped the movement of transport which was a major challenge for marketing of agriculture commodities.

- **Preparedness of Market yards and collection centres by avoiding crowd**

The main marketing centres of agricultural crops are markets operated by APMC and State Marketing Boards. Some of market yards and seasonal in nature means they operates only in harvesting season and remain closed for rest of year. Others are full time operational like fruits and vegetable markets of consuming areas. Majority of seasonal harvest come in seasonal yard for which preparation like repair and maintenance, arrangement of drinking water and sanitation, cleaning arrangement, repair and installation of grading machinery etc are performed before the harvesting season. But due to lockdown at starting of harvest season has affected the preparation of these arrangements.

- **Maintaining social distancing and hygiene in Markets**

Agricultural markets are generally a crowded place as large number of stake holders visits these markets like farmers, labourers, transporters, weighmen, traders, commission agents etc. To operate these markets during COVID19 period was very challenging by following the necessary norms like maintaining social distancing and proper hygiene during the operations of market.

- **Encourage minimum touch/contact with Agriculture/Horticulture Produce**

The nature of spread of corona virus is through droplets of infected person. The virus in these droplets will remain live for long time on infected surfaces. Since all the post-harvest marketing operations were manual hence there were greater chances of infection at any stage of marketing. So, to manage the minimum contact of harvested crops is great challenge during the operation of market.

- **Losses incurred in trade due to lockdown**

Marketing of agricultural commodity is a business activity. Like any other business activity there is need of liquidity in market and significant capital is required to run the business. But due to lockdown the flow of liquidity was adversely affected and there are significant losses to traders particularly fruits and vegetables due to spoilage of crops in transit. Many of them have lost the capital which will run the future business. Hence the shortage of liquidity was very big challenge.

- **Slowing down of intercultural operations particularly horticultural crops like mango, grapes and apple**

Due to non-availability of labour and agro chemicals the intercultural operation specially plant protection sprays were affected or recommended practices could not be adopted. Due to this there are chances that the productivity would suffer. This will have impact on demand, supply and prices in coming months.

- **Decrease in demand due to closure of hotel and other bulk buyers**

The food servicing sector was closed during the lockdown. All the hotels, restaurants

and other food points were closed. Due to this the demand for these bulk buyers was almost became zero, which affected the prices and value chain. The most severe category which was affected is farmers of high value crops and commercial crops. Marketing of these commodities became a very big challenge.

- **Availability of packing material**

All the packing material manufactures were closed during the lockdown. The supply of raw material was also stopped. This affected the production and movement of ready material. The shortage of packing material was observed in areas where harvesting of crop was going on. This has also impacted the supply chain of packing material in area where crops in ready in next 2-3 months and large quantity of packing material is required.

- **Restriction on movement of traders**

Traders play a very important role in price discovery of agricultural commodities. It is believed that the prices are high when there are large numbers of buyers. These buyers come from different parts of country to buy the produce. Due to spread of COVID19 their movement was restricted which has affected the prices of commodities. This will also affect the future prices of commodities in markets as there are strict quarantine norms to move from one place to another.

- **Availability of supporting activities like auto repairs, spare parts, eateries hotel, lodges etc.**

Although the movement of vehicles carrying agricultural produce was allowed during lockdown and curfew period but the supporting activities like repair and spare, hotels and dhabas etc were closed. This discourages the drivers and other functionaries to do the transportation activities.

Steps taken to address the challenges of COVID19

Central and state government has taken many steps to manage the situation. Various micro innovations are happening at ground level depending upon necessity. Some of innovative steps are as under;

Steps taken at state Government and wholesale market level;

- Agricultural Marketing department and marketing boards has advised Standard operating procedures (SOPs) for operations of whole sale markets. Emphasis was given to maintain proper social distancing and hygiene in wholesale markets. Recommended chemical was sprayed in premises of market on daily basis.
- Special marking of places in yard was made for vehicles and farmers coming to wholesale markets. Separate places were identified for farmer's vehicles and loader's vehicles. Separate timings were fixed for operation of both the activities.
- All the visitors of wholesale market were thermally scanned for any symptoms of

COVID19. If there were any flu like symptom, they were asked to leave the market and consult health officials. All the visitors were hand sanitized. All the vehicles coming to wholesale markets were also sanitized with recommended chemicals.

- It was made compulsory to wear mask in market. Face masks were provided to market functionaries like drivers, hamals, labourers' etc. To make aware about the various do's and don'ts to avoid spread of virus, marketing was done through public hoardings, flex hoardings, notice board messages and man to man contact.
- Some agricultural wholesale markets have installed hand free wash basins to enable the visitors to wash their hands frequently without touching the tap of bottle of sanitizer. These wash basins are foot operated and developed by at local level by fabricators.
- During the harvest time, permits were issued to labourers for crop cutting. They were directed to maintain social distancing and wear face masks.
- In some markets where there is huge arrival during marketing season, Token system was adopted to avoid rush. Farmers were told to dry the crop as per specifications and if moisture level is high, their produce will be rejected. This lead to extend the marketing season of crop and long queues were avoided. Some APMCs has introduced token system and desired numbers of farmers were allowed to enter the market. This avoided the crowding in market and helped in maintaining social distancing.

Steps taken at Union Government level:

- Ministry of Agriculture and farmers welfare has launched Kisan Rath App on 17/04/20 to facilitate the logistics. This application is quite helpful to farmers for arranging the vehicle to carry the harvested produce to market. This is also helpful to the trader to carry the commodity from one market to other market.
- All India Transport Call centre (1800 180 4200 and 14488) was set up to facilitate logistic related problems. This number can be accessed from any phone from all over India. It helped the movement of vehicle seamlessly across the borders. This helpline coordinates between various state governments and solve any transport related issue.
- Kissan rails were operated by Indian Railways during lockdown period over 67 routes, which helped to maintain supply during the crises period.
- 100 new markets were connected with e-NAM and total number of wholesale markets linked with e-NAM are now 1000.
- During the COVID19 period Union Government fixed aggressive procurement targets so that maximum crops which come to market can be purchased by Food Corporation of India, NAFED or State procurement agency. The numbers of procurement centres were also increased to 2790 from last year 1485.

Challenges Ahead:

Agricultural wholesale markets act as a very important component of Agricultural supply chain. On one hand it monetize the farmers and on other hand ensures supply to consumers. A

lot of market functionaries operate in these markets so these markets are more prone to COVID19 infections. However in current situation these markets have managed to curtail the spread except a few exceptions and are operating with almost full capacity. However, there are great challenges in future due to COVID19 and its impact on agriculture and national economy as whole. Some of major challenges which can crop in future are as under:

- This pandemic has affected the resource movement. There is liquidity crunch in system, Traders has incurred losses, labour has migrated to native places and many more. So, to streamline the system all the resources need to be arranged optimally to their specific position/location, which is a major challenge in future.
- Optimum storage utilization plays a key role to stabilization of prices and availability of commodity. Due to COVID19, the commodity stored in cold stores, CA or MA Stores, god owns etc. Could not be moved due to lockdown. The challenge ahead is to move out the stored produce, maintenance of machinery and get it ready for storage of next crops. Highly efficient system of marketing and logistic support is required for it else there will be huge supply of commodity i.e. stored produce and next harvest which will affect the price and profitability.
- COVID19 will affect the future decision making of farmers toward crops diversification like English vegetables, flowers etc. if new alternatives or markets were not discovered for high value crops. These crops are consumed in hospitality industry and due to their closure, there is no buyer. Efforts of Government to promote diversification toward horticulture and other perishable crops will receive a set back as more and more farmers will plan to grow traditional crops like paddy and wheat to avoid risk and to get assured price through Minimum support price.
- International business is very badly affected due to COVID19. Very high fluctuation in exchange rate has also changed the dynamics of export and import. Its impact will be commodity specific as some will get benefit and other will lose. However, there will be significant shrinkage of international business and income level of household will decline which will affect the consumption. Unemployment level with rise due to possible recession which will affect the buying behaviour.

Suggestions:

To meet the challenges posed by COVID19 and its impact on Indian agriculture, some immediate and long-term steps are required by Central and State Government. Some of suggestions are;

- A need was felt to constitute a national level task force comprising the representatives of Ministry of agriculture a farmer's welfare, state marketing department / marketing boards and other stake holder who will plan the new strategy to meet the future challenges. This body can co-ordinate or operate the various function like Kisan rath app, National logistic support helpline, surplus deficit conditions etc.

- Decentralize the supply chain system and develop alternate centres which can operate in case of emergency situations. Dependence of one or two big markets needs to be changed.
- Re-assess the availability and utility of storage capacity keeping in view the production of Agri commodities and their consumption.
- Big and liberal Investment is required in Agri-market infrastructure and its professional management .
- Effective implementation and extra allocation of funds to Market intervention schemes to maintain market stabilization.
- Model on Credit in trade should be developed on e- NAM as most of Agri supply chain system runs on credit and it is not available on e-NAM.
- Efforts should be made to increase interstate and intra state trade in e-NAM. This can be done through easy issuance of licenses within state or outside the state. A National level facilitation centre is required which can guide the traders.
- Developing stake holder specific training modules of e-NAM activities and trade. E.g. Farmer module, trader module, transporter module etc.

References:

- Acharya, S.S. and Agarwal, N.S (1999), Agricultural Marketing in India, Oxford and IBH Publishing House, New Delhi.
- Press information Bureau, Government of India (2020, May 15), Third advance estimates of production of food grains, oilseeds and other commercial crops for 2019-20 [Press Release]. Retrieved from [https:// pib.gov.in/allRel.aspx](https://pib.gov.in/allRel.aspx)
- Chauhan, Anil (2016, April 27), Marketing of apple in Shimla [Blog Post]. Retrieved from [http:// himachalhorticulture.blogspot.com/2016](http://himachalhorticulture.blogspot.com/2016).

Social Distancing During Harvesting



Social Distancing During Auctioning



Infrared Temp Scanning



Proper Traffic Management



Foot Operated Wash Basin



Sanitization of Vehicles



Unconventional Strategies for reaching Customers during Lockdown Period

V K. Jayaraghavendra Rao, ICAR-Indian institute of Horticultural Research Bengaluru -560089

Email Id: vkj.rao@icar.gov.in

Introduction

Due to the global pandemic public and private, professional and business operations in primary, secondary and tertiary sectors are halted, Agriculture/horticulture is affected because labour force has become limited for doing agricultural operations, especially harvest and post-harvest operations of the crops cultivated and mature during summer 2020 and preparatory operations for the crops of kharif 2020. When the supply chain operations are absent, marketing of harvested produce to the buyers and again to the consumers become a bigger challenge. These conditions add further challenges to the farmers, who are in distress situation due to the non-availability of labour force for doing agricultural operations. We are right now in Rabi Harvest, and Mango Harvest, Food supply chains to be disrupted as of April/May-June 2020. Reduction in labour force, affecting labour intensive forms of production in (agriculture/horticulture).

There has been supply shock in terms of logistics of movement of food, Scarcity of supply may lead to artificial increase in demand and people, Transport restrictions and quarantine measures likely to impede farmers' access to input and output markets, curbing productive capacities and denying a point of sale for produce; potential to raise PHL- packaging, handling and logistics, Food supply chains disrupted; blockages to transport routes particularly obstructive for fresh food supply chains and may also result in increased levels of food losses and waste, Prices of agricultural commodities drop 20% post COVID19 outbreak, The export price of grapes at farm gate has fallen from about Rs 100 per kg to Rs 70-75 per kg, Wholesale sugar prices too have fallen 4% during the past fortnight.

During Lockdown Unconventional Virtual supply and value chains were established and they need to be strengthened. Collaborate and connect customer management services with network facilitator, entrepreneurs and marketing stakeholders can make a simple smooth marketing decorum affair even during crisis such as COVID lock down.

The poultry industry, which has suffered the most due to coronavirus related rumours Prices of agricultural commodities drop 20% post COVID19 outbreak, Prices of agricultural commodities such as perishable vegetables, grapes and sugar have fallen 15-20% as bulk demand from hotels and restaurants has nosedived and there is uncertainty over exports. Demand for perishables has declined as bulk demand has stopped. However, there is more demand for vegetables that have longer shelf life, such as onions, potatoes and tomatoes. Farm-gate prices have fallen due to scare of COVID19. The export price of grapes at farm gate has fallen from about Rs 100 per kg to Rs 70-75 per kg. However, packaging and dispatches for exports have not decreased. With the expected steep reduction in demand due to sudden stoppage of exports and imports and also domestic sales due to the closure of malls and retail

showrooms, the industry is likely to face unprecedented and severe losses. Decline in meat consumption -zoonotic fears in spite of price drops in Non-Veg food commodities especially in case of chicken. Rise in demand for vegetarian and nutritious horticultural commodities, Loss of income-earning opportunities and reduction in outside consumption, Fear of contagion reduced visits to food markets, malls and supermarkets, Hotels and restaurants closed and increased e-commerce deliveries, through Big basket, Amazon etc has caused rise in consumption at home.

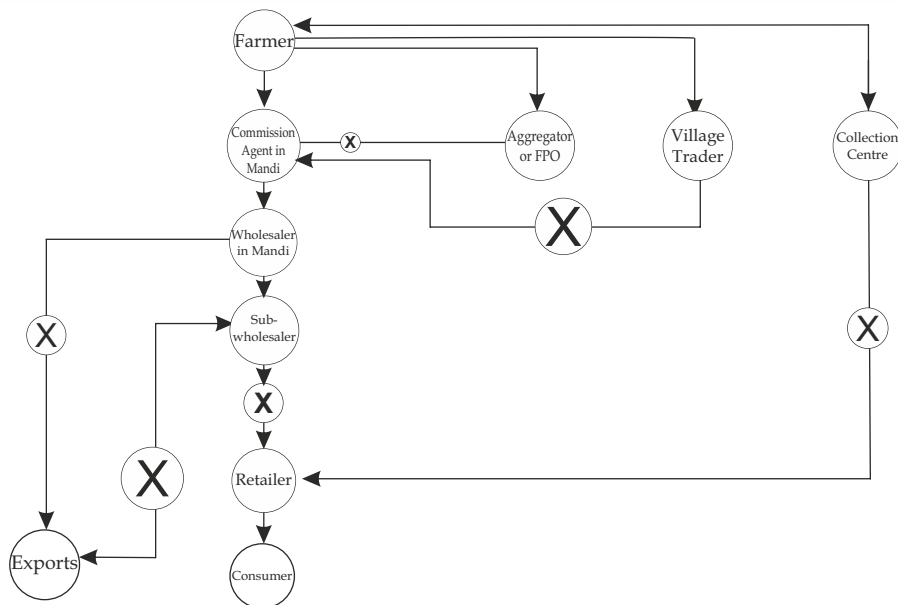
The Loss

For the financial year FY20 real GDP that is 140-150 lakh crore., has reduced by 35 percent, In Mumbai the 21-day long national lockdown leads to 80 per cent production loss, the economy will take a hit of 35,000-40,000 crore on a daily basis, shaving off 6.3-7.2 lakh crore cumulatively, says Care Ratings. Assuming 300 working days in a year, the daily output comes to 45-50,000 crore which can potentially be lost due to the shutdowns, Assuming 80 per cent production is lost, and 20 per cent of the economy (that constitutes the essential services and farming) still functions, 35-40000 crore of GDP will be lost every day. For agriculture/horticulture, even though food grain/horticultural commodities may not be reaching the cities and towns, which means even though farmer income may not increase, production is recorded.

Post COVID Situation

The disrupted supply chain has affected the consumers and producers due to non-reaching of the commodities from producer to consumer through the broken supply chain as shown in figure

How COVID19 is impacting the rural market



About 70% of population working under agriculture is nearly about 70%, in which the rural population is 80%. The agriculture is contributing in India’s national income very vastly. The agriculture share in the gross domestic product of India is 20.5%. (Published: April 26, 2020) 5:03:45 PM) 69% of India’s population resides in rural areas, which constitutes to more than

700 million people, Export shutdown, job cuts, supply chain delays ,Weak financial quarters, job losses, salary cuts, lower profit margins were seen besides large number of transporters are yet to receive their permits, There is Increased the time taken for the farm produce to reach the market, and there was slight impact on the demand side as the restaurants have been ordered to shut revenue loss to many farmers, The 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 and settle with a lower profit. There was also delay in sowing and harvesting of crops, due to the unavailability of products such as seeds, tractors, ancillary support and medicines for crop protection. 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 (ATMANIRBHAR)

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. businesses are shut down and facing a revenue hit. Many let go of their employees for a variety of reasons including financial viability, migration, health and other. Therefore, 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 COVID19.

Once things return to normal, the primary focus of people would be to secure jobs and get their businesses going. Further adding to the woes families and businesses will be keeping stringent checks on their spending patterns.

In 2017-18, total food grain production was estimated at 275 million tonnes (MT). ... [153] It is the second-largest producer of rice, wheat, sugarcane, cotton and groundnuts, as well as the second-largest fruit and vegetable producer, accounting for 10.9% and 8.6% of the world fruit and vegetable production, respectively.

Coping strategies adopted by the system

Many online platforms, apart from Amazon, Flipkar, Big basket jumped into the fray aggressively during the lockdown period, start-ups like Zapp fresh, Tender cuts and Fresh to Home have been marketing aggressively during the period, and Meengal a fishery app developed by TNFDC also aggressively marketed during the COVID lockdown.

UAS Alumni association Bengaluru also directly marketed the produce through their network y doing farmer to consumer sales. Farmers directly marketed on a P to C model though social media, Whatsapp, Instagram, and the like, through social branding, even B2C, BB, and P 2 C and C2 P marketing were seen, Direct marketing channels side-lining the middlemen were seen as a welcome change and an opportunity to do unconventional business.

Which platform?

People right from the webinar to marketing platforms used a variety of software's zoom, hangout, Microsoft team, and cisco webex, and all these platforms got tremendous downloads and usage statistics during the period.

National Animal Disease Control Programme

The National Animal Disease Control Programme for Foot and Mouth Disease (FMD) and Brucellosis launched with total outlay of Rs. 13,343 crores. It ensures 100% vaccination of cattle, buffalo, sheep, goat and pig population (total 53 crore animals) for Foot and Mouth Disease (FMD) and for brucellosis. Till date, 1.5 crore cows & buffaloes tagged and vaccinated. Animal Husbandry Infrastructure Development Fund of - Rs. 15,000 crores have been allocated, In many areas in country with high milk production having great potential for private investment in dairy, aims to support private investment in Dairy Processing, value addition and cattle feed infrastructure, for which an animal Husbandry Infrastructure Development Fund of Rs. 15,000 crores will be set up and incentives to be given for establishing plants for export of niche products.

Promotion of Herbal Cultivation: Rs. 4000 Crores

The National Medicinal Plants Board (NMPB) has supported, 2.25 lac hectare area under cultivation of medicinal plants, 10,00,000 hectares will be covered under Herbal cultivation in next two years with outlay of Rs. 4000 crores, This Will lead to Rs. 5,000 crores income generation for farmers through Network of regional Mandis for Medicinal Plants. NMPB will bring 800-hectare area by developing a corridor of medicinal plants along the banks of Ganga.

Beekeeping initiatives - Rs 500 crores

The Atmanirbhar package also concentrates on Beekeeping as a livelihood supporting activity for rural areas, which increases the yield & quality of crops through pollination and provides honey and other beehive products like wax. The Government will implement a scheme for infrastructural development related to Integrated Beekeeping Development Centres, Collection, Marketing and Storage Centres, Post-Harvest & value Addition facilities etc; and shall be responsible for the Implementation of standards & Developing traceability system, the entire focus is on the Capacity building with thrust on women, through whom the Development of quality nucleus stock and bee breeders is to be given impetus, This will lead to increase in income for 2 lakh beekeepers and quality honey to consumers.

From 'TOP' to TOTAL - Rs 500 crores

Since the Supply chains have been disrupted and farmers are not being able to sell their produce in the markets due to distress sale and reduction of price of perishable fruits and vegetables at the farm level needs to be prevented. Therefore, Operation Greens will be extended from Tomatoes, Onion and Potatoes (TOP) to all fruits and vegetables (TOTAL). The Scheme features will be as follows: 50% subsidy on transportation from surplus to deficient markets. 50% subsidy on storage, including cold storages. Pilot for 6 months - Will be expanded and extended, Expected outcomes: Better price realization to farmers, reduced wastages, affordability of products for consumers.

Social Media Integration

During the lockdown a lot of social media integration took place for Agri marketing as the main media was just broadcasting the COVID information and the farmers distress and Agri marketing problem.

Agri-Startups-RAFTAAR

In the RKVY-RAFTAAR MANAGE called for training the Agri startups to promote small and medium level entrepreneurship during catastrophe and contingency periods.

Phone-in Programs To Mitigate Crisis

Many institutions, the first line, the front line and regular extension adopted to the Phone in programs to mitigate distress, during the lockdown.

Multipurpose Outlets

The multipurpose outlets run by milk parlor, hotels, and provision stores all in one shops and startups emerged during the crisis, and people saw a diversity of business models, from C2P, B2B, P2C, and other models emerged including a series of Webinars on the subject to create awareness and Technology for vending mobile vans developed by IIHR was used extensively during the period to door deliver the goods and services, Crop advisory, crop planning, and crop zoning was aggressively campaigned through virtual platforms and the stakeholders were kept in touch. This led to the unconventional supply chains, Farmers were respected, and middlemen were sidelined.

Driving the Economy during Crisis Such as COVID

The biggest worry due to COVID19 is the scale of unemployment and income loss to stakeholders, only two sectors can drive this recovery, one the Government front loading its expenditure (DA has been frozen) and money is pumped in, the Banking sector augmenting credit to all sectors. And further ensuring that local purchases of food and food components for humanitarian purposes are exempt from restrictions and reach all households with pertinent public information on food assistance, nutrition and hardship alleviation programmes. This also includes a PM GARIK Kalyan Yojana for 15,000 Crores towards anti COVID Health and 7,800 Crore loss of revenue.

Conclusions

To conclude Virtual supply and value chains were established and they need to be strengthened further, Train people to link through zoom, WebEx, social media, ICAR-IIHR, CCSNIAM to create, producer, aggregator, transporter data base and link to customer aggregates, Flats, hostels, institutions. Develop local e-savvy entrepreneurs, specialized in virtual supply and value chains. ICAR-IIHR and CCSNIAM to run a certificate course on such entrepreneurs by sync, collaborate, connect and network, facilitators, entrepreneurs. Encourage reverse migration, encourage local supply chains through e-platforms, aggregate, connect, compete and collaborate, Discover Customer Management services and build efficiencies, avoiding public conglomerations and malls and reducing infections, develop local e-savvy entrepreneurs, specialized in virtual supply and value chains. Need to run a certificate course on such entrepreneurs. Lastly sync, collaborate, connect and network, facilitators, entrepreneurs and make Agri marketing a simple smooth affair.

References

- <https://economictimes.indiatimes.com/news/economy/agriculture/prices-of-agricultural-commodities-drop-20-post-COVID19-outbreak/articleshow/74705537.cms?from=mdr>

Use of ICT in Agricultural Marketing

Dr. P. Murali and Dr. D. Puthira Prathap,

Scientist (Ag. Economics), ICAR- Sugarcane Breeding Institute, Coimbatore- 641007,

Principal Scientist (Ag. Extension), ICAR- Sugarcane Breeding Institute, Coimbatore- 641007,

Email Id: muralisundar@rediffmail.com, puthira@yahoo.com

Introduction

Agriculture was practiced formerly on a subsistence basis, the villages were self-sufficient, people exchanged their goods and services within the village/outside area on a barter basis. Since the beginning of the civilization, agriculture has been the primary occupation of the majority of the people of India, be it ancient India, British India or modern India. 48 per cent of people earn for their livelihood from the agriculture and it is ranked second in the farm output of the world. It is the functionality of the small holder farming is the basic. They route the small and marginal farmers to restore the problems to become the fulcrum of the green revolution ever with the enormous growth in the agricultural sector. Some of the factors that limit the farmers in the increase of their incomes are the difficulty in accessing the technology available, government policies, available resources, markets for the products and other institutional services.

ICT solutions launched in India to deliver price information to small farmers, even weather, crop advisory, fertilizer availability and updates on government schemes. This helps them to bargain and increase their incomes by enabling them to better manage their inventories and negotiate for fairer prices. Providing technical assistance on marketing skills to farmers, therefore, will continue to be important during crisis situation such as COVID19.

The development of transport and storage facilities, agriculture has been commercialized as a business entity. The farmer raises those crops that fetch a better price. Marketing of agricultural produce is considered as an integral part of agriculture, since an agriculturist is encouraged to make more investment and to increase production. Thus, there is an increasing awareness that it is not enough to produce a crop or animal product and it must be marketed as well.

Marketing is defined as the process of identifying, communicating and maintaining relationships with buyers of a producer's products to directly affect volume, value and timing of sales. Marketing activities enable a producer to find new buyers, build and maintain relationships with current buyers and access market research to manage supply, anticipate demands and establish prices. Agricultural marketing involves in its rudimentary form the buying and selling of agricultural produce. This definition of agricultural marketing may be accepted in age old days, when the village economy was more or less self-sufficient, when the marketing of agricultural produce presented no difficulty, as the farmer sold his produce directly to the consumer on a cash or barter basis. But, in modern times, marketing of agricultural produce is different from that of olden days. In modern marketing, agricultural

produce has to undergo a series of transfers or exchanges from one hand to another before it finally reaches the consumer.

ICT also facilitates market research, increasingly using live information. This market information strengthens farmers' position in their day-to-day trading. Over time, market intelligence enables them to focus on satisfying consumers' and buyers' demands and on developing relationships with stakeholders in the next stage of the value chain. The key development challenge lies in assembling and disseminating this information in a timely manner, not just to traders or larger scale farmers but also to smallholders.

In light of the situation, the Government of India (GoI) has placed inclusive growth as its overriding goal in its 11th Five Year Plan (2008-2012). It prioritizes reduction of regional and rural-urban disparity as well as chronic poverty through inclusive growth. GoI highlights private sector-led agricultural growth through greater crop diversification, higher value addition and improved farmer-market linkage, as an important driver for poverty reduction and rural economic growth. In doing so, Government emphasizes the need to ensure that small and marginal farmers also get benefitted. It lists out the development of agribusiness and contract farming as a means to integrate these small land holders into the agricultural value chain while specifically stating the importance of giving the poor adequate bargaining power through group formation.

It aims at increasing private sector investment in agribusiness and enhances the integration of small farmers, including female farmers, into the agricultural value chains for high value crops (fruit and vegetables) by improving physical and institutional linkages between various stakeholders. It does so through the following four components: (i) agribusiness market infrastructure development; (ii) support infrastructure (e.g.- road, transport, packaging, power, water supply etc) development; (iii) market intelligence improvement; and (iv) capacity building and value chain linkages strengthening.

ICT technology gives users the ability to tap into a wider range of knowledge and information than they could access previously. Research is emerging on just how much farmers are starting to use mobile phones to assist in marketing their production. The survey work in Bangladesh, China, India, and Vietnam showed that about 80 percent of farmers own mobile phones (Minten, Reardon, and Chen. N.D). Mobile phones are used to speak to multiple traders to establish prices and market demand, and more than half of smallholder farmers concluded selling arrangements and prices on the phone. ICT solutions offer the opportunity to enhance marketing, role of ICTs, impacts and challenges are discussed in the chapter.

Role of ICT on marketing

A growing body of knowledge indicates that phones, tablets, TV and radio, mobile phones, and increasingly smartphones have a positive impact on agricultural income. This technology gives users the ability to tap into a wider range of knowledge and information than they could access previously. Research is emerging on just how much farmers are starting to use mobile phones to assist in marketing their production. Greater access to information and buyers

steadily adds to farmers' market knowledge and gives them greater confidence to diversify products. The additional knowledge translates into a more accurate understanding of demand and an enhanced ability to control production and manage supply chains.

1. Farmer Networks

Farmers build up a network of contacts and draw on this wider experience and expertise to obtain critical information more rapidly. With phones, farmers deal directly with wholesalers or larger-scale intermediaries rather than small-scale intermediaries. Farmers who own mobile phones have also proven able to develop a broader network of contacts than their peers who do not own them.

Studies have shown that in Malaysia, for example, mobile phone use was linked to increased profits among younger owner/managers of farms and smaller agribusinesses. A survey of 134 younger agricultural-based entrepreneurs asked for their perceptions of the impact of mobile phones on their businesses. The two overarching benefits reported were that they could draw upon a wider network of people for information (a "wisdom of crowds" effect), and they could obtain information at a greatly increased speed (Shaffril et al. 2009). Other benefits such as market information, time savings, and technology were of a lower order. The overall impact was an increase in profits from their businesses, especially after the entrepreneurs had used their mobile phones for more than two years.

2. Price and Location

An ability to compare prices increases farmers' power to negotiate with traders. It also enhances farmers' ability to change the time and place of marketing to capture a better price. Profitability is highly affected by control of marketing their produce and orienting their production to identified market opportunities. In essence, the ability to conduct market research to gather both short and long term information will increasingly become part of the mix of farming skills.

One of the most influential studies of the impact of mobile phones was carried out by Jensen (2007), who tracked effects on the fisheries subsector as mobile phone coverage was extended along the coast of Kerala, South India. The results were dramatic. Because farmers could identify the best markets for selling their catch, price volatility was reduced, wastage was significantly lower, fishermen achieved higher average prices, and consumer prices fell.

Studies in Niger have found that mobile phones bring better price integration, improve profits for traders, and reduce consumer prices. Aker (2008) found that mobile phones reduced search costs by 50 percent compared with personal travel. Traders' profits increased by 29 percent not because they traded more products but because they obtained better prices through real time market research conducted via mobile phone. Mobile phones were also associated with a 3.5 percent reduction in average consumer grain prices.

A survey of a small sample of farmers in Morocco found that mobile phone use resulted in a 21 percent increase in income (Ilahiane 2007). An even more relevant finding was that the

technology changed farmers' behaviour; increasingly, they spoke directly with wholesalers or larger-scale intermediaries rather than smaller intermediaries. Farmers switched markets to capture better prices coordinated with local truckers to improve product transportation. A particularly important change was that they used their new knowledge to become more market oriented in their production, moved away from producing low-value crops, and diversified into higher-value enterprises. The knowledge gained from using the mobile phone reduced the perceived levels of risk and helped them target their production to specific, identified market opportunities.

Svensson and Yanagizawa (2009) assessed how prices paid to farmers were influenced by market information collected by the Market Information Service Project and disseminated through local FM radio. The information was broadcast through daily bulletins of 2 to 4 minutes and a longer weekly program that provided district market prices. The access to a radio was associated with a 15 % higher farm-gate price. Where market information was not disseminated through the radio, there was no effect. The results suggest that reducing the information asymmetries between farmers and other intermediaries increased farmers' bargaining power.

One of India's leading private companies, ITC, has annual revenues of US\$7 billion and 29,000 employees. It is active in fast-moving consumer goods, hotels, paper and packaging, agribusiness, and information technology. Through its e-Copal program, it has established Internet access kiosks across rural India to both enable farmers to retrieve market information and to serve as a sales channel for its products (Table.1).

Table.1. Agricultural Interventions made through e-Chou pal Kiosks and Their Effects

Type of agricultural Technology or Practice	Before e-copal: 2000	E-choupal intervention	Effects
Seed use per unit area	For soybeans, farmers used a high planting density (45–50 kg seeds/acre)	Farmers advised to use a lower planting density (30–35 kg seeds/acre)	Savings: 10 kg seeds/acre (Rs 200/acre)
Seed of verified quality	Farmers' limited awareness of benefits of certified and foundation seeds led to limited use of such seeds	The e-Choupal demonstrated the benefits of foundation and certified seeds through its agricultural extension program (Choupal Pradarshan Khet)	Yield increase and self-sufficiency in seeds (for self-fertilizing, non-hybrid crops)
Seed treatment	Low awareness of benefits of seed treatment	The e-Choupal spread awareness about benefits of seed treatment and provided treated seeds to some farmers	Germination percentage and yields increased significantly

New varieties and improved timing of planting	Farmers used varieties inappropriate for local conditions (climate, pest, and disease incidence and timing of rainfall)	The e-Choupal suggested new varieties suitable for adverse conditions and advised farmers how to better align planting with rainfall	Most suitable variety planted on time, leading to higher yields
Weed and other pest management	Farmers controlled weeds by hand; for pest control, they were largely guided by local input dealers	The e-Choupal suggested use of herbicides and/or pesticides in specific circumstances	Effective weed and pest control leading to low loss of yield
Soil testing	No awareness of soil testing and consequent benefits	The a-Choupal propagated the practice of replenishing soil nutrients based on soil testing reports	Reduced fertilizer costs and more appropriate nutrients applied
Storage practices and market linkages	Low awareness of hygienic practices for stored crops; limited opportunities to sell products	The e-Choupal advised storage of grain based on moisture content to avoid loss and contamination; it offered farmers alternate opportunities to sell their products	Reduced losses from poor storage practices as well as better earnings from the sale of output

It has launched a ICT project in 2000, the kiosks operate in 40,000 Indian villages and reach approximately 4 million farmers. These kiosks are hubs where farmers can obtain price information, seek options for selling their produce, buy inputs, and obtain advice on farming practices related to input use. This service is free of charge; ITC earns revenues through commodity transactions at the kiosks and through advertising other goods via the kiosks such as agricultural inputs. Ultimately, ITC expects half of its revenue to come from input sales through its Webenabled e-Choupal network. In addition to the kiosks, ITC also offers information services to farmers via mobile phone, thus deepening its relationship with the farmer and enabling them to make more informed decisions (Kumar N.D.).

3. Negotiations

Research on negotiation approaches indicates that it is important to obtain as much information as possible prior to a potential transaction. This information should include the trading patterns, goals, and preferences of those that one is negotiating with. Groups provided with more information in advance achieved more effective and efficient outcomes as well as higher levels of satisfaction with the negotiation.

Research on tomato farmers' negotiations with rural traders in Ethiopia showed that, on average, farmers' initial asking price was about three times higher than the final price they obtained from buyers (Jaleta and Gardebroek 2007). Yet when farmers had market price information typically obtained by a mobile phone call to acquaintances close to the central market the difference between their initial asking price and the final price was reduced by 16.5 percent. In other words, market information increased farmers' bargaining power by one-sixth.

Goyal (2008) compared farmer prices in the regulated market (mandi) for soybeans in two areas of Madhya Pradesh, India. In some areas, 1,600 e-Choupals Internet kiosks operated by the aforementioned agribusiness company ITC disseminated price information, whereas the other areas relied only on the mandi for such information. Goyal found that farmers obtained better prices when they had access to a wider range of market information. Farmers' price increases ranged from 1 percent to 5 percent, with an average of 1.6 percent. The additional farm income from soybeans in Madhya Pradesh was estimated at about US\$10–20 million per year. This income was almost certainly a transfer from traders to producers as a result of producers' greater market knowledge and improved strength in negotiation.

Increasingly, ICT is being used to integrate markets and bring in more transparency and opportunities. This provides many opportunities for empowering the negotiation position of smallholder farmers. The Government of Karnataka (India), for example, has been implementing electronic markets (e-mandi) for the past many years. This has been found to improve marketing efficiency through competitive and transparent bidding mechanisms and by minimizing manipulations in trading practices (Athawale 2014). Now this approach is being scaled at national level by the Government of India, which plans to integrate 585 wholesale markets through a common electronic platform (The Hindu 2015).

4. Supply and Demand

Farmers gain greater control over their production and product sales by finding new sources of demand, improving their ability to adjust supply and quality to market conditions, and learning about quality, grades, and product presentation. Over the longer term, a better understanding of market demand and consumer trends helps farmers diversify into higher-value crops and capture greater value. Farmers can also make more informed decisions about which inputs are better or cheaper to buy and when and where to best obtain them.

5. Transportation and Logistics

Farmers can organize and coordinate among themselves and (larger-scale) truckers to consolidate volume and leverage economies of scale. Greater coordination also occurs around the timing of aggregation, collection, and volumes. Larger volumes lower costs and enable farmers to realize higher prices.

Evidence indicates that farmers increasingly use mobile phones for real-time market research. In Bangladesh, for example, about 80 percent of farmers now have mobile phones; of these, two-thirds have owned mobile phones for three to five years (Minten, Reardon, and Chen N.D). About 70 percent of rice growers and 30 percent of potato growers contact multiple traders by phone to explore selling opportunities and prices, and about 60 percent will agree on the details of the trading deal over the phone. In parallel with mobile phone growth, smartphone penetration is also growing throughout the world.

The Impact of ICT on Farmers

Price is disseminated in many ways chalked on notice boards, broadcast by local radio stations, published in newspapers, texted on mobile phones and (more recently) posted on websites and circulated via smartphones. The scale of the effect on farmers' prices appears to depend on a number of factors, including, the effectiveness of the informal market information networks that already exist. The stability of the price structure (for example, whether the government controls prices for a staple crop or whether fixed-contract pricing is widely used). The summary of impact of ICT on marketing is depicted in the Table.2.

Table.2. Summary of ICT's Impact on Farmers' Prices, Incomes, Traders' Margins and Prices to Consumers

Location, product, medium (study authors)	Farmer	Trader	Consumer	Comments
Uganda, maize, radio (Svensson and Yanagizawa 2009)	+ 15%			Increase in price paid to farmers considered to be due to farmers' improved bargaining power
Peru, range of enterprises, public phones (Chong, Galdo, and Torero 2005)	+ 13%			Increases in farm income, but higher for nonfarm enterprises
India (West Bengal), potatoes, SMS (M.Torero , IFPRI, pers. comm.)	+ 19%			Yet to be published, but showed information to be important both in the form of SMS and as a price ticker board in markets
Philippines, range of crops, mobile phones (Labonne and Chase 2009)	+ 11-17%			Effect on income among commercial against subsistence farmers and increase in producers' trust of traders
India (Madhya Pradesh), soybeans, Webbased e-Choupal (Gayal 2008)	+ 1-5% (average: 1.6%)			Transfer of margin from traders to farmers, effect seen shortly after e-Choupal established
Sri Lanka, vegetables, SMS (Lokanathan and de Silva, pers. comm.)	+ 23.4%			Appreciable price advantage over control over time, plus benefits such as increased interaction with traders and exploring alternative crop options
India (Maharashtra), range of products, SMS (Fafchamps and Mintenn.d)	No significant effect			In this one-year study, quantitative analysis did not show any overall price benefit, but this finding is thought to be due to sales in state by auction; price benefits of 9% were observed with farm-gate sales and younger farmers
India (Kerala), fisheries, mobile phones (Jensen 2007)	+ 8%		-4%	Outlier in the sense that fish catches are highly variable and fishermen have their own boat transportation

Circumstantial evidence suggests that market information systems have a greater effect on prices of higher value, less perishable products such as onions, potatoes, beans and a lesser effect on prices of extremely perishable products, such as leaf salad. ICT may have a greater effect where negotiation is part of the sales process and a lesser effect when sales are by auction.

Sharing the Benefits

In many countries, profits generated by mobile phone use in urban areas are set aside specifically for extending the mobile phone network further into rural areas. In occasional instances, technologies such as mobile phone amplifiers and transmitters, focused on marketplaces, can extend the distance over which wireless signals travel and can encourage additional agricultural trade to emerge. Although ICT appears to reduce transaction costs, in the past most of these cost savings accrued to traders who invested in mobile phones. Little analytical work has been done to provide empirical evidence of these effects. These kinds of studies are likely to be important for informing better investment decisions on infrastructure, particularly at the nexus between investments in roads, markets and communication technology. Given accelerating urbanization and the increasing emphasis on food security, the development sector needs a better understanding of how to ensure that the reductions in transaction costs that are possible along the agricultural supply chain especially benefit the rural producers and urban consumers. It can be argued that if the situation were left to resolve itself, the bulk of the benefits generated by these new market opportunities would go to the larger scale and better off farmers and to the trading sector. To redress this imbalance, there may be a role for extension to alert farmers to new market opportunities, provide training on changing market conditions (especially experiential training), and transmit important market intelligence, especially through the Internet. The role of ICT in current and future scenario is depicted in the Table.3.

Table 3 Current and Future Roles of ICT in Agricultural Marketing

FUNCTION DELIVERED BY ICT	ENABLING OR DELIBERATE	TECHNOLOGY	FUTURE
Real-time market research	Enabling infrastructure	Fixed-line and mobile phones	Extending range of mobile phones and ICT, facilitated by infrastructure investment and policies
Coordination of logistics	Enabling infrastructure	Fixed-line and mobile phones	Specialist applications, training/producer organizations
Market information (price and supply)	Deliberate: Public and private sector	Web-based and SMS	Applications and public-private sector partnership, plus training and organization
Market intelligence	Deliberate	Web-based	Applications and development of market intelligence services, plus training and organizations
Inputs	Enabling infrastructure	Fixed-line and mobile phones	Targets SMS messaged by private sector, e-vouchers for subsidies

Source: Shane Hamill (consultant, the world bank). Module 9 strengthening agricultural market access with ICT

ICT application in the agriculture sector has started bringing transformation in the Indian Agriculture by ensuring the free flow of information to the farmers regarding the newer and better production techniques, Agri management, commodity prices and Agri marketing etc. ICT application has helped in declining the role of middlemen and brokers in the whole

process as a result of which the exploitation rate has decreased. ICT application in agriculture has specifically helped the rural farmers by which they are being able to know the minimum price, the maximum price of each commodity on daily basis from a remote area only by use of the internet.

Basic voice calls have already empowered smallholders by expanding their immediate communication networks to be in contact with a wider circle of potential buyers. A study in Benin has showed that using mobile phones facilitates transactions and provides producers access to relevant, timely information, allowing them to sell at a higher price improve their income. Beyond voice, however, current ICT solutions offer limited access to new buyers for smallholders, though several systems promise greater benefits in the future. Integrated farm management solutions plan to offer capabilities to connect with new buyers.

Google Trader is designed to support this function and is ostensibly targeted at large, mid- and small-sized agricultural producers with web access, but there is little evidence to date that there is consistent or sustainable usage. Anecdotally, there is some evidence of agricultural producers finding new buyers through global social networks. Through Alibaba.com (the Chinese business to business portal), one Ethiopian honey exporter located a Chinese buyer, arranged a site visit and hosted the buyer, then successfully completed a volume sale. This honey exporter sourced his product from hundreds of small farmers who benefitted from the sale. However, this is just one example and does not yet represent proof of the model on a larger scale.

Impact of ICT on agricultural marketing

ICT has the maximum impact on agricultural marketing. It has become the most important weapon in the agricultural reform process in India, and through the various scheme, the price related information and the market-related information is made available to common people and the farmers easily and even free of cost.

- Broader and deeper networks; Farmers communicate by phone with traders and farmers outside of their immediate geography, as opposed to making a physical trip. The ability to communicate more easily and to triangulate information creates deeper trust in key trading relationships.
- More sophisticated marketing plans based on price information; Farmers can modify the date of marketing, product permitting, or switch to alternate markets, transportation and regulation permitting. Producers also use market information to decide when to harvest produce or, if possible, where to store it until they can sell it at higher prices.
- Improved negotiation power; Farmers increase their power to negotiate, particularly with traders, based on their ability to understand pricing in multiple markets, to cut out intermediaries, and to sell directly to largescale buyers.
- Future production and marketing choices; Aside from increasing their profits and competitiveness through immediately useful information related to prices, markets, and

logistics, farmers also require information about market changes that may influence their production and marketing choices over the longer term.

- Reduced logistics and transportation costs. Farmers obtain the latest information with a phone call instead of making a long trip to a market.

One of the main challenges is the trust factor that must be overcome for buyers to turn to new ICT-enabled forums as an alternative to their relationship-based trade. In addition, there are often not accepted or understood grading standards for many of the agricultural products that smallholders produce, meaning that buyers often do not know the exact quality of the crop until they see it for themselves. Until a sufficient level of trust and quality standards within these forums is established, it may be necessary for providers or organizations encouraging the use of these services to serve as an intermediary or broker.

Conclusions

ICT solutions are being launched in developing countries worldwide to deliver market information to small farmers. Pricing is the most widely shared information with other information provided including weather, crop advisory, fertilizer availability and updates on government schemes. Studies have shown that using ICT to deliver this type of information can benefit smallholder farmers by raising their bargaining power and increasing their incomes (by enabling them to better manage their inventories and negotiate for fairer prices), reducing price dispersion (variation in prices which creates market inefficiencies) and by reducing year to year price variations (stabilizing risks).

Although the ultimate sustainability of the models is still unproven in the long term, there have been some measurable benefits to small farmers. Interestingly, the benefits do not appear to be uniformly applicable to all types of market information. For instance, a randomized control trial of 1,000 farmers using Esoko's market information service in Ghana found that farmers received between 7-11% increases in the price of yams, but no noticeable price increase for maize and cassava.

One of the most immediate benefits of ICT solutions to smallholder farmers is in reducing transport and logistics costs of obtaining market information. Personal travel is traditionally the most common method of obtaining market information. For example, rather than having to walk miles to a local market to meet a trader, farmers can make a voice call to establish whether price and quantities demanded for a product that day are worth the travel effort. A study in Niger, for example, found that an average trip for an agricultural labourer to a market located 65km away can take 2 to 4 hours' roundtrip, as compared to a two-minute call, which translates to cost savings of US\$0.50 per trip (assuming daily wage of \$US1).

ICT presents unprecedented opportunities to empower smallholder farmers by strengthening their capabilities in marketing their products. Despite these opportunities, it is worthwhile reinforcing the fact that there is no single, best ICT solution for all circumstances. Also, although we often use the phrase 'ICT solution', technology is not the solution on its own, but rather a tool that can be used to help you better achieve your objectives. As an increasing number of smallholder farmers expand their networks through ICT, those with the most

refined marketing skills will likely reap more benefits than those without. Providing technical assistance on marketing skills to farmers, therefore, will continue to be important.

It is important to recognize that more research is needed to explore exactly when and how access to market price information benefits smallholder farmers. While there are clearly examples of benefits to farmers in specific cases, development practitioners should tread carefully before assuming that access to this information alone is sufficient to farmers' obtaining higher prices. However, the ICT application in agriculture has boosted up the agricultural development of the country indirectly resulting into economic development.

References

- ACDI/VOCA (Agricultural Cooperative Development International/ Volunteers in Overseas Cooperative Assistance). 2011. "India: Growth-Oriented Micro Enterprise Development Program (GMED)." <http://www.acdivoca.org/site/ID/indiaGMED>.
- Anitha, H., Navyashree, C. 2015. Role of Information Technology in Agricultural Production and Marketing. *Adarsh Journal of Management Research*, 5(2), 11-16.
- Athawale, S., 2014. "APMC and E-Trading for Financial Inclusiveness in Karnataka". *IBMRD's Journal of Management and Research*.
- Bangladesh. <https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html>.
- Banjo, G., H. Gordon, and J, Riverson. 2010. "Rural Transport:
- Barrett, C. B., M. E. Bachke, M. F. Bellemare, H. C. Michelson, S. Narayanan, and T. F. Walker. 2010. "Smallholder Participation in Agricultural Value Chains: Comparative Evidence from Three Continents." MPRA Paper, University Library of Munich. *Econ papers*, <http://econpapers.repec.org/RePEc:pra:mprapa:27829>, accessed July 2011.
- BTRC (Bangladesh Telecommunications Regulatory Commission). 2016. *Mobile Phone Subscribers in Bangladesh, 2016*. <http://www.btrc.gov.bd/telco/mobile>.
- CARE. 2008. "TIPCEE Program Profile Brief." <http://edu.care.org/Documents/Program Profile Brief TIPCEE.pdf>.
- CESS (Centre for Economic and Social Studies). 2007. "Preparatory Study for the Multi-State Agricultural Competitiveness Project." Unpublished study, CESS, Hyderabad.
- CRS. Farm Book Business Planning Tools webinar, February 13, 2013.
- Dr. V. Rengarajan et al (2018). Role of ICT Based Services in Agricultural Marketing in Kanchipuram District – A Study Using One-Way ANOVA. *International Journal of Pure and Applied Mathematics*. Vol.119(15): 1025-1034
- Facebook Page: Jalpaiguri District Small Tea Growers Association
- FAO (Food and Agriculture Organization). 2005. "Case Study: Community Based Information Systems, India, EID Parry

- Google. 2016. "How Loon Works" (accessed March 8, 2016), <https://www.google.com/loon/how/>.
- Hildebrandt, N., Y. Nyarko, G. Romagnoli, and E. Soldani. 2015. "Price Information, Inter-Village Networks, and Bargaining Spill overs: Experimental Evidence from Ghana." New York University.
- ICT Application for Distribution and Supply Chain Management in African Agriculture." Micro Links (January). <http://microlinks.kdid.org/library/ict-application-distribution-and-supply-chain-management-African-agriculture>.
- Improving Its Contribution to Rural Growth and Poverty Reduction in Sub-Saharan Africa." World Bank, Washington, DC.
- Indiagriline." <http://www.fao.org/rdd/doc/EID%20Parry%20%20Indiagriline.pdf>.
- ITC. 2010. ITC e-Choupal's Agri Interventions.
- Mittal, S., S. Gandhi, and G. Tripathi. 2010. "Socio-Economic Impact of Mobile Phones on Indian Agriculture." Working Paper 246. Delhi: Indian Council for Research on International Economic Relations (ICRIER). <http://www.icrier.org/pdf/WorkingPaper246.pdf>.
- Mohammadi, R. (2011). Challenges and Implications of ICT Application for Improving the Marketing of Agricultural Products. ARCC Journal, 31, 161-166.
- The Hindu. 2015. "Govt Allocates Rs. 200 Crore for National Agriculture Market" (accessed 22 March 2016), <http://www.thehindu.com/news/national/govt-allocates-rs-200-crore-for-national-agriculture-market/article7378470.ece>.
- TruTrade. 2015. "Giving Farmers a Better Deal" (accessed February 25, 2016), <http://www.trustrade.net/about-us>.
- USAID (United States Agency for International Development). 2009. "TIPCEE GIS Work." Cop Horti, [http://www.cop-horti.net/IMG/pdf/TIPCEE GIS Work Feb 2009.pdf](http://www.cop-horti.net/IMG/pdf/TIPCEE_GIS_Work_Feb_2009.pdf).
- Using ICT to Enhance Marketing for Small Agricultural Producers" (accessed February 26, 2016), <https://agrilinks.org/sites/default/files/resource/files/Using ICT to Enhance Marketing for Small Agricultural Producers.pdf>.
- Virtual City. 2009. "Case Study: Virtual City Agri Manager Solution." <http://www.virtualcity.co.ke/cases/agrimanagrcase.pdf>.
- World Bank. 2008. Agriculture for Development: World Development Report 2008. Washington, DC: World Bank.
- World Economic Forum. 2009. The Next Billions: Business Strategies to Enhance Food Value Chains and Empower the Poor. Geneva: World Economic Forum. [http://www.weforum.org/docs/WEF_FB Food Value Chains and Poor Report 2009.pdf](http://www.weforum.org/docs/WEF_FB_Food_Value_Chains_and_Poor_Report_2009.pdf).

Maize: Crop and Post-Harvest Management During COVID19 Situation

M. C. Dagla, Pardeep Kumar, Bharat Bhushan, Ramesh Kumar and S. B. Singh
ICAR-Indian Institute of Maize Research, PAU Campus, Ludhiana, Punjab
ICAR-IIMR, Regional Maize Research & Seed Production Centre, Begusarai, Bihar
Email: manu9322gen@gmail.com

Introduction

Maize is the third most important cereal crop in the world after wheat and rice and is known as the 'Queen of Cereals' as it has the high genetic potential for yield. It is cultivated in 9.2 million hectares, with 27.8 million tonnes of production in India. Maize is less water demanding as compared to wheat and rice and gives higher yield. About 15% of cultivated area of maize is under irrigation. Through cultivating maize farmers save 90% of water and 70% of power compared to paddy cultivation⁷.

Maize is used as food for human and, feed and fodder for animals, and also source of more than 3500 diverse food products all over the world⁷. It can be converted into a variety of functional foods. The major constituent of the corn kernel is starch which is used in foods and industrial products. The starch is also converted into glucose/fructose as food sweeteners. Glucose can be fermented into ethanol for fuel or beverages. In addition to use of its normal grains, there are some popular speciality types of maize such as baby corn, sweet corn, and pop-corn.

With multi-facet use such as food, feed and industrial crop globally maize has a very prominent role to play in the Indian economy. Expansion of mechanization is the need of hour as there is shortage of farm workers during lock down, need for timely farming operations to increase productivity. Local storage facilities and processing units for baby corn, sweet corn, and grain processing should be established and re-designed and strengthened.

Maize consumption in India can broadly be divided into three categories, viz., feed, food and industrial products; primarily starch. The feed accounts for about 60% of the maize consumption in India. The most important use and high demand driver of maize is poultry feed which accounts 47% of total maize consumption, while livestock feed accounts for 13%. The food consumption accounts for 20% of maize produce, with direct consumption being 13% and that in form of processed food is about 7%⁷.

In our country, maize may qualify as potential crop for doubling farmer's income. This is an important crop to India also as 15 million farmers are engaged in maize cultivation. It generates employment of more than 650 million person-days at farm. The feed industry growing at a 9% CAGR (Compound Annual Growth Rate) presents huge opportunity for maize growers. Maize also has potential of creating jobs in the industrial sector, where several promising products are derived from maize processing⁷.

The USA produces more than 32% of the world's maize production followed by China, Brazil, and Argentina. The world production of maize in 2018 was around 1147 million metric tonnes. India produces about 2.5% the world's maize production, and share in maize area is about 4.7%. About 71% of maize in India is produced in the Kharif season (Karnataka, Madhya Pradesh, Tamil Nadu, Maharashtra, Telangana, Uttar Pradesh and Rajasthan). Bihar, Andhra Pradesh and Tamil Nadu are states which produce rabi maize crop. Rabi is the primary crop of Bihar and Andhra Pradesh ⁶.

The USA has the highest productivity of maize that is 11.9 tonnes per hectare, followed by China and Argentina (6.1), Indonesia (5.3) and Brazil (5.1). India has about 3 tonnes per hectare maize productivity⁸. India has less productivity of maize; and the reasons are; adverse climatic conditions, cultivation is largely in rain-fed environment on marginal lands with insufficient irrigation. The farmers have the limited adoption of improved technologies. Only about 30 percent of area is under hybrid and deficiencies in the production and distribution system of quality seed⁸. Small farm holdings and limited resource availability with farmers are major reasons behind less productivity of maize in India.

COVID19 is a viral disease in which corona virus attacks on human body through respiratory system and creating threats to human life all over the world. In normal life, performing day-to-day work for all age groups of humans has become difficult. This viral infection spreads through direct or indirect contacts of one person to another person. In India, government has taken steps for lockdown in different stages. In such lockdown conditions, we have to perform essential agricultural works as our food production should not be affected. Maize is an important food as well as industrial crop, which is being grown over the year in kharif and rabiseasons, and to an extent in spring season also. In such situation, farmers have to perform all the activities from sowing to harvesting in field, then post-harvest processing, storage and marketing. In this chapter, we are discussing about how to perform all these agricultural practices, and suggesting some of the important ways so that this virus doesn't affect farmers' and workers' health and maize farming also not affected.

Maize cultivation

As maize is being grown in kharif, rabi and spring seasons in a year, it is necessary to discuss here that in which month which field activities are to be performed by farmers. So, crop calendar is being given below:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
					<i>Kharif Sowing</i>	<i>Kharif Growth</i>	<i>Kharif Harvesting</i>				
<i>Rabi Growth</i>	<i>Rabi Harvesting</i>					<i>Rabi Sowing</i>					
<i>Spring Sowing</i>			<i>Spring Harvesting</i>								

As spring season maize is in the field and at flowering and post-flowering stage during presenting this webinar, hence, the upcoming activities in spring maize are being discussed. The unconventional spring season is becoming a viable option in northern India. The spring maize is generally sown at the end of January or first week of February, which provides an opportunity to utilize the fields vacated by crops such as potato. This would also help in meeting the ever increasing demand of green ears during the early summer. In Haryana, spring maize is being grown in rice-potato-maize cropping system and it has been found highly remunerative to the farmers. During spring season, high yielding early maturing maize cultivars also hold promise as they have the potential to escape high temperature stress (mid-April to May) during flowering and maturity. Maize in this season may be grown under the assured irrigation due to high temperature at flowering and grain filling stages.

Sick person should not be allowed for field works especially who has symptoms like cough and breathing problems. There should be all safety guards for farm workers such as soap, sanitizer and mask if there is any group activity. Cultural operations like spray of insecticides, if needed, must have all the safety measures for containment of corona virus. Irrigation does not require persons-in-group, though spades/implements being used should not be exchanged one to another person in same day. In every morning, before starting of work, handles of implements must be sanitized properly. Locally known and available workers should be preferred for harvesting and field operations to avoid movement of workers between regions or blocks¹².

Harvesting and threshing

As *rabi* maize is in harvesting stage hence harvesting and threshing also to be performed with having the health safety measures. Simple measures include social distancing, maintaining personal hygiene by washing of hands with soap, wearing of face mask, protective clothing and cleaning of implements and machinery. The workers have to follow safety measures and social distancing at each and every step in the entire process of field operations¹¹. Mechanical harvesting does not require workers-in-group so there is no chance of unintentional mingling. However, if machine and operator move one area to another area, such drivers/operators shall stay in strict isolation to undertake harvesting operations without mingling with the masses. For manual harvesting, workers should be deployed in such a way that they must maintain social distancing and escaped from indirect touch through small implements¹². In baby corn, sweet corn, and for green cobs generally manual picking is practiced, hence social distancing should be maintained and accomplish the operation in 4-5 feet spaced strips assigning one strip to one person, ensuring enough spacing between the engaged labours. All the persons engaged should use masks and ensure hand washing with soap at regular intervals. Workers should maintain safe distance of 3-4 feet during rest, taking of meals, transfer of produce at collection point, loading/unloading etc. Stagger the field operations wherever possible so that it avoids a greater number of persons on the same day. Farmers should have familiar persons to the extent possible and shall do reasonable enquiry as to avoid the entry of any suspect or likely carrier of COVID19 during field activity¹¹.

Mechanized operations should be preferred over the manual wherever feasible and only the essential numbers of persons should be allowed with the machine. All machines should be sanitized at the entry point and at regular intervals also. All transport vehicles, gunny bags or other packaging material should also be sanitized. The collection of the produce may be done in small heaps spaced at 3-4 feet and field level processing should be assigned to 1-2 persons per heap to avoid crowding. Proper sanitation and cleanliness of threshers for harvested maize is to be maintained especially when machines are shared and used by farmer groups. Copious washing of machine parts frequently touched with soap or sanitizer is advised. Only after proper drying of cobs, shelling is done. At the farm level while performing drying, threshing, winnowing, cleaning, grading, sorting and packaging operations and filling bags require workers-in-group hence proper social distancing must be maintained and wearing of protective face mask may help against aerosols and dust particles to transmit from person to person¹¹.

Storage of Maize Grains

The whole nation should be made to realize that 'a grain saved is a grain produced'. About 5-7% of maize produced in India is generally lost due to improper storage⁶. Improving storage can help reduce this post-harvest crop loss. Before storage, proper drying of grain is essential; moisture should be 9-12%. Ensure proper drying prior to storage of harvested maize grain at farm/home and farmers should not reuse previous season's jute bags for transport the cobs so as to prevent pest infestation. Use treated bags like their soaking in 5% *neem* solution and then dried gunny bags. Adequate precautions shall be taken for storage of maize cobs at the farm in jute bags that are made available in sufficient numbers to farmers or in nearby cold storages/go-downs/ warehouses, if needed for better price realization¹¹. All storage go-downs must be cleaned and fumigated before storage to avoid infestation of storage insect-pests. There should be proper management for temperature, humidity and aeration. At the time of putting grain or bags in store houses and dragging out from storage, social distancing must be in practice. Storage facility of maize grains may be ensured at affordable and, in reaches of farmers at farm or local level so that the farmers are not forced to distress sale.

Marketing of maize

Farmers are facing the problem of drying, shelling and subsequent sale in the present scenario of COVID19. Since farmers face the problem of workers in taking up post-harvest processing, they may be forced to go for distress sale. The government needs to intervene to ensure that maize grains are procured in *mandis* at least on minimum support price. The storage facility of maize grain must also be ensured at *taluka* levels. If the crop is lodged anywhere due to hailstorm it needs to be assessed by the government to save distress farmers by paying suitable compensation. Adequate health safety measures to be taken for loading and transporting of farm produce and while participating in sale at market yards/ auction platforms.

For safety of health of workers in coming time; farms, warehouses, processing plants, *mandis* should eliminate unnecessary visitors. Operating practices at farm, storage, warehouses,

mandis/ auction platforms and processing plants should be re-structured to enable workers to practice social distancing. Health professionals should take temperatures of employees and make sure they are wearing masks, gloves and other protective gears. We must find best ways to strike a balance between the need to keep production going and the necessity of protecting the workers. Measures should be put in place to assure the safety of farm workers. On-site healthcare professionals can ensure that no workers are ill ¹⁰.

Continuing the food supply chain and support to smallholder farmers

The food value chain of staple commodity like maize has high-end value products like baby corn and sweet corn. The logistics to distribute these commodities is affected in these days, as it is hampering the food transportation across cities, regions and countries. Logistical barriers that disrupt the food supply chains affects the high-value produce even more as these are perishable, such as baby corn and sweet corn. The important staple commodities-exporting countries need to formulate efforts to minimize these logistics disturbances, so that these commodities can be transported across countries. The logistics components of the supply chain need to be properly tested and given special permits to transport essential food commodities ¹⁰.

Any constraints to domestic trade, including technical and practical hurdles, should be removed in order to link small land-holding farmers to markets. Governments should make efforts to meet the basic energy needs of poor farmers and rural households. In rural areas for many children, school closures mean that they don't have access to healthy diet, and for food producers it turns into loss of earnings. Local governments must consider an alternative to school meals, such as home delivery of meal to keep the producers employed and make children nourished. During an emergency, governments can purchase agricultural products from smallholder farmers to establish strategic emergency reserves especially for non-perishable commodities to boost food supply ¹⁰.

Quality Protein Maize (QPM)

Nutritional quality of maize protein is poor due to inadequate essential amino acids like lysine and tryptophan. The QPM essentially has about twice the levels of lysine and tryptophan than normal maize and also increased levels of histidine, arginine, aspartic acid and glycine, but reduced level of leucine. The biological value of protein in QPM is just double than that of normal maize protein which is very close to the milk protein as the biological value of milk and QPM proteins are 90% and 80%, respectively¹. The improved cultivars of QPM are HQPM-1, HQPM-5, HQPM-7, Vivek QPM-9, Shaktiman-1, Shaktiman-2, Shaktiman-3, Shaktiman-4, and Shakti-1.

Pop Corn

Popcorn is hard endosperm flint maize; its kernels are very small and oval/round in shape. It is one of the common snack items in many parts of the world, particularly in cities and is liked because of its light, porous and crunchy texture. It is consumed fresh, as it has to be protected

against moisture absorption from the air. When heated at about 17°C, the grains swell and burst, turning inside out. Quality of popcorn depends on popping volume and minimum number of non-popcorns³. The improved cultivars of popcorn are DMRHP-1402, Jawahar, Amber, Pearl and VL Popcorn.

The normal corn, QPM, and popcorn all have same production practices except some technical field practices modifications. The baby corn, sweet corn and fodder maize has some different practices with regard to harvesting and post-harvest practices.

Baby Corn: A Vegetable

Baby corn is a young finger like unfertilized cob of maize with 2-3 cm emerged silk, harvested within 1-3 days of silk emergence. It can be eaten raw as salad, preparing *chutney*, vegetables, pickles, *kheer*, etc. The desirable size of baby corn is 6-11 cm length with 1-1.5 cm in diameter with regular row arrangement. It is the 'safest' vegetable to eat as it is wrapped in husk naturally, and no effect of some pesticides and diseases. It is very nutritive and its nutritional quality is as good as seasonal vegetables. Besides protein (10%), vitamins and iron, it is also rich source of phosphorus. With the best management practices baby corn crop gives 55-120 quintals husked baby corn, or 15-20 quintal dehusked baby corn per hectare. As baby corn is picked at early stage of crop, and crop remains green at harvesting, hence these green plants may be used for fodder purpose and 150-400 quintals per hectare fodder is harvested as additional income to the farmers⁵.

Baby corn has also additional advantages, as it is also used as fresh vegetable hence its cultivation in peri-urban areas provides market and promotes diversification of crops in the fields. It also generates employment as its value addition and supply chain needs human resource, and in short possible time one can earn more money. As above discussed, it is demanded in foreign countries also hence it has high potential for export. In addition to main produce, it also provides quality fodder for livestock⁵.

Grades of Baby Corn: For marketing purpose grading is done on the basis of dimension size of baby corn, which fits these products for fetching high price in national as well as in international market.

Table: Grades of Baby Corn⁵

Grade	Length	Diameter	Marketing
Short	4-7 cm	1.0-1.2 cm	International
Medium	7-11 cm	1.2-1.4 cm	International
Long	11-13 cm	1.4-1.5 cm	Local

There are some hybrids of baby corn which may be used by farmers for better yield; these are G-5414, G-5417, HM-4, IMHB-1532, IMHB-1539, VL BC-1, and CMVL BC-2.

Sweet Corn

It is a very delicious and rich source of energy, vitamins C and A. It is eaten as raw, boiled or steamed green cobs/grain, and used in preparation of soup, salad and other recipes. It is becoming very popular in urban areas of country hence; its farming is remunerative for peri-urban farmers. Generally sweet corn is early in maturity, harvested in 70-75 days after sowing or 18-20 days after pollination. At the harvest time the moisture is generally 70% in the grain and sugar content varies from 11 to more than 20%. Green cobs should be immediately transported to the cold storage in refrigerated trucks to avoid the conversion of sugar to starch³. The improved cultivars of sweet corn are HSC-1, Sugar-75, Madhuri, Win orange, and Priya.

Maize as good source of fodder and silage

The cultivation of maize for fodder can be done round the year. Its quality is adversely affected after anthesis, hence to maintain the fodder quality regarding better digestibility and palatability the detasseling is advised to the farmers. The tall, leafy and longer duration cultivars are most preferred; in general, the farmers grow composite varieties or go for advance generation of hybrid seed which is economical to the farmers. Maize gives 400-500 quintal per hectare green fodder yield⁴. The important cultivars of maize for fodder purpose are African Tall, J-1006 and Pratap Chari-6.

Maize fodder can be used for making silage which can be used during the period of scarcity of green forages called lean periods. It is a nutritious feed that preserves the nutrients of green forages in their original form and hence it is as good as green forages. Even hard stems become soft in silage and better utilized by animals. Most of the anti-nutritional components present in the green forages are either destroyed or lowered down during silage fermentation. The practice of silage making can reduce the shortage of green fodder in the country, and helps in expanding and flourishing the dairy sector as the supply of nutritious fodder is ensured round the year. The manual labour cost is considerably reduced as 4-5 persons can easily manage a flock of 40-50 cattle heads, since maximum labour is consumed in daily harvesting of green forages. Baby corn as well as sweet corn stalks are the best fit fodder for silage making as the entire field is harvested in one go. One-time harvesting is beneficial in many ways since the crop can be harvested at the appropriate time and at the same time the field becomes available for sowing of next crop².

Fall armyworm (FAW) and its management

There are many insect-pests and diseases which affect the maize crop at different stages, as discussed, the spring maize in the field and at flowering stage and this pest is harmful for flowering and grain filling stage. From last two years, fall armyworm (*Spodoptera frugiperda*) has emerged as a big threat to maize, so it is necessary to discuss some important control measures for this insect-pest. FAW was detected for the first time on the Indian subcontinent around mid-May in maize fields at the College of Agriculture, University of Agricultural and

Horticultural Sciences (UAHS), Shivamogga, Karnataka. FAW is very hazardous insect-pest of maize crop as it can fly long distances; 100km per night, 2000km per lifetime, it has six larval instars and larval period is usually 14-28 days, the female lay eggs in clusters of fifty to a few hundred and one can lay up to 1000 eggs in a lifetime, thus it can complete 6-12 generations per season. For management of FAW farmers should follow weekly scouting and adopt symptom-based control measures on action thresholds as follows⁹:

- 1. Seedling to early whorl stage (0-2 weeks) at first catch of 1 moth/trap and/or 5% infested plants:** First spray should be done with 5% Neem Seed Kernel Emulsion (NSKE) or azadirachtin 1500ppm @ 5mL/L of water. Second spray should be done with *Bacillus thuringiensis* variety *kurstaki* (BtK) formulations @ 2g/L of water. If the infestation crosses 10% at this stage, spray any of the following chemical pesticides; spinetoram 11.7% SC @ 0.5mL or chlorantraniliprole 18.5 SC @ 0.4 mL or thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC @ 0.25 mL per litre of water.
- 2. Early whorl to mid-whorl stage (2-4 weeks) at 5-10 % infested plants:** First spray should be done with BtK formulations @ 2g/L water. If the infestation crosses 10%; spray any of the following chemical pesticides spinetoram 11.7% SC @ 0.5 mL or chlorantraniliprole 18.5% SC @ 0.4 mL or thiamethoxam 12.6 % + lambda cyhalothrin 9.5% ZC @ 0.25 mL per litre of water.
- 3. Mid-whorl to late-whorl stage (4-7 weeks) at 10-20 % infested plants:** First spray may be done with any of the following pesticides, but for second spray alternate the pesticides; spinetoram 11.7% SC @ 0.5 mL or chlorantraniliprole 18.5% SC @ 0.4 mL or thiamethoxam 12.6 % + lambda cyhalothrin 9.5% ZC @ 0.25 mL per litre of water. If bigger larvae are found feeding inside the whorl, apply thiodicarb 75% WP based poison bait.
- 4. Late-whorl stage (7 weeks) at ≥ 20 % infestation:** Spray with any of the following chemical pesticides, and alternate the pesticide for second spray; spinetoram 11.7% SC @ 0.5 mL or chlorantraniliprole 18.5% SC @ 0.4 mL or thiamethoxam 12.6% + lambda cyhalothrin 9.5% ZC @ 0.25 mL per litre of water. If bigger larvae are found feeding inside the whorl, apply thiodicarb 75% WP based poison bait.
- 5. Tasseling stage to harvest:** No insecticide application at this stage, but manually pick and destroy the larvae if observed $\geq 10\%$ ear damage.

MAKKA: A mobile app

ICAR-Indian Institute of Maize Research developed a mobile App MAKKA (Maize Agri-Knowledge & Know-how App) to provide information, different advisories and help farmers and other stakeholders. It contains information about cultivars, package of practices, insect and disease management. It also contains information about weed management, application of nutrient and fertilizers and mechanisation. It has all informations in *Hindi* language also.

Conclusion

Maize is a multi-faceted crop used as food, feed and industrial crop globally, and has a very prominent role to play in the Indian economy. Expansion of mechanization is the need of hour as there is shortage of farm workers, need for timely farming operations to increase productivity. If COVID19 situation will prolong, we must have habits of social distancing, washing hands frequently, avoiding unnecessary touch to things and own mouth. Local storage facilities and processing units for baby corn, sweet corn, and grain processing should be established and re-designed and strengthened in such a way for avoiding such viral disease. India needs to reorient the value chain to serve the basic goal of remunerative prices for farmers. There is need in further enhancement of advance technology for spreading agricultural information (very essential as FAW for maize, and COVID19 situation) to farming communities. Considering multiple ends uses of maize, including in the industrial sector, there exists a wide scope for private sector participation through contract farming, FPOs, and agri-value system platform.

References:

1. Graham GG, Lembcke J, Morales E. (1990) Quality-protein maize as the sole source of dietary protein and fat for rapidly growing young children. *Pediatrics*. 85(1): 85-91.
2. D. P. Choudhary, Ramesh Kumar, Sapna, Shiwani Mandhania, R. S. Kumar and SainDass (2011) Corn Silage -A nutritious feed for livestock. Published by Directorate of Maize Research, New Delhi.
3. C.M. Parihar, S. L. Jat, A.K. Singh, R. Sai Kumar, K.S. Hooda, Chikkappa G.K. and D.K. Singh (2011) Maize Production Technologies in India. Published by Directorate of Maize Research, Pusa Campus, New Delhi. <https://iimr.icar.gov.in/wp-content/uploads/2020/03/Maize-production-technologies-03012017.pdf>
4. D.P. Chaudhary, Ashwani Kumar, Sapna S. Mandhania, P. Srivastava and R. S. Kumar (2012) Maize As Fodder? An alternative approach. Published by Directorate of Maize Research, Pusa Campus, New Delhi.
5. Sain Dass, V.K. Yadav, Asha Kwatra, M.L. Jat, Sujay Rakshit, Jyoti Kaul, Ishwar Singh, K.P. Singh and J.C. Sekhar (2012) Baby Corn in India. Published by Directorate of Maize Research, New Delhi.
6. 2017-NCoMMSPECIAL REPORT MAIZE.
7. 2018-Maize Vision-2022: A knowledge Report FICCI.
8. 2018-FAOSTAT.
9. Suby SB, Lakshmi Soujanya P, MLK Reddy, Jawala Jindal, Maha Singh, Sushant Mahadik, Puttaram Naik, Ravi Kesavan, JC Sekhar and Sujay Rakshit (2019)

Identification and management of fall armyworm (*Spodoptera frugiperda*). Technocal Bulletin. Published by ICAR-Indian Institute of Maize Research, Ludhiana. <https://iimr.icar.gov.in/wp-content/uploads/2020/03/ICAR-IIMR-English-folder-FAW-Identification-and-mangnt-1.pdf>

10. 2020-FAO: COVID19 and the risk to food supply chains: How to respond? Rome <https://doi.org/10.4060/ca8388en>.
11. 2020-Guidelines for farmers and farming sector during lockdown period due to COVID19 issued by ICAR, New Delhi.
12. 2020-Advisory for maize farmers in view lockdown to contain Corona (COVID19) issued by ICAR-Indian Institute of Maize Research, Ludhiana.

Do's and Don'ts for the farmers in COVID period

Roshan Lal Meena, Scientist (Agronomy), ICAR-NBSS & LUP, RC, Udaipur,
Email Id: roshan.meena34@gmail.com

Introduction:

COVID19 is a viral disease that was first reported in humans from Wuhan City, China, in December 2019. COVID19 spreads through respiratory droplets. When someone infected with COVID19 coughs or exhales they release droplets of infected fluid that fall on nearby surfaces and objects, such as desks, tables or telephones. People could catch COVID19 by touching contaminated surfaces or objects, and then touching their eyes, nose, or mouth. It has soon become a pandemic affecting almost all the countries in the world. India gets corona infected people in March, 2020 and the country's leaders and bureaucrats decided to lockdown the country in phases to prevent the contamination of the virus.

Farmers can get better price of their produce with following advisory mentioned in Do's and Don'ts in COVID period, Use of ICTs, knowledge-based input and participation of government with farmers in timely advisory of weather and climate will assure good flow for market information and lead to farmers welfare.

The impact of COVID19 on the economy is no doubt devastating. No sector has escaped its impact. Its impact on agriculture is complex and varied across diverse segments that form the agricultural value chain. Even among the different segments, its impact varies widely among different regions and among producers and agricultural wage labourers.

India's ongoing lockdown to control the spread of coronavirus is impacting the agriculture sector as it overlaps with the time of harvest of rabi crops. The lockdown has derailed harvest preparation and lack of agricultural labour to help in harvest and restrictions on transportation with uncertain operations of markets. The non-availability of labour has hurt operations in many parts. Some parts of agriculture that have the luxury of deploying technology for harvesting, like paddy and wheat, are relatively more insulated since they often do not have to depend on large numbers of manual labour. The increasing use of mechanical harvesters for paddy has helped in the present circumstances, though their inter-state movement has been severely curtailed. However, commercial crops are drastically hit as they tend to be more dependent on migrant labour. Consequently, the shortage of migrant labour has resulted in a sharp increase in daily wages for harvesting of crops. In many areas, the rise is as high as 50 percent, making it non-remunerative for producers since prices have collapsed due to either lack of market access including the stoppage of transportation and closure of borders. This is in contrast to areas where migrant labourers have returned home from urban areas and this has led to a sharp decline in agricultural wages.

Agricultural producers are particularly hard hit with returns on produce varying from one-third the usual or a complete loss. In a number of districts, inter-state trade in commercial crops or proximity to urban areas provides market access and better prices. These are often due to initiatives of individual farmers rather than direct state support. This is often the case of crops like onions, cotton, mango, inland fisheries, flowers and vegetables. The rise in labour costs and lack of access means that farmers are staring at huge losses and hence allowing crops to rot in the fields, a better 'stop-loss' mechanism. Those who have avoided a complete loss barely eke out any money to cover the cost let alone household maintenance or land lease rates.

Government also announced a package of 1.7 trillion rupees to boost the agriculture sector of the country and to strengthen the employment involved in it but farmer leaders and agriculture experts raising concerns and criticizing the relief package announced by the government to aid farmers impacted by the lockdown. They also expressed fear that once the lockdown is lifted the crash in prices would severely impact the income of millions of farmers. So, keeping above in mind government has release an advisory to farmers on do's and don'ts for the farmers during COVID period to provide them timely guidelines, to get maximum benefit from their produce in addition to other government announcements.

COVID19 problems and agriculture

The prolonged lockdown along with rain and hailstorm in many regions has heightened rural distress, pushing anxious villagers to moneylenders – a situation which farm leaders say can trigger agitations and suicides unless farmers get quick relief. The disruption in wholesale market and transportation have ravaged the rural economy. Farmers are chopping orchards, ploughing blooming fields of flowers and selling produce at throwaway prices. The absence of field-level assessment by insurance companies is making compensation difficult. For mango growers, market disruption is a bigger threat than the virus. “Nearly 55% of the Alphonso (crop) that grows in Maharashtra is sold at the wholesale markets of Mumbai, Pune and Kolhapur, all of which are closed now. In Uttar Pradesh, buyers are not making advance purchases. About 70% of the output, which is transported to other states, is stranded because of transportation hurdles and shortage of packaging.



Objectives:

The article aims to address the issue of spread of COVID19 among the farmers with the emphasis of following general advisories while, performing agricultural operations.

Do's and Don'ts for farmers during COVID19 period:

Do's-

- ✓ The government has exempted farming operations, farm workers, custom hiring centers of farm harvesters and implements as well as mandis and procurement agencies from the lockdown rules, so farmers can go to the market for the sale of farm output.
- ✓ Follow social distancing and safety precaution while handling farm machines and labour in the field.
- ✓ For tackling any emerging issue related to managing crops, livestock and fisheries, farmers should consult and be in touch with Agri-scientists in Krishi Vigyan Kendra (KVK), ICAR research institutes and state agricultural universities for timely advisories.
- ✓ The disease crisis has coincided with the harvesting season of rabi food crops such as wheat, millets, pulses and oilseeds and other crops, so farmers need to take precautions as they will be engaged in the harvesting of grains, fruits and vegetables, milk, eggs and fish.
- ✓ Similarly, proper sanitation is required for using shared or hired machinery for harvesting.
- ✓ Use ICTs for Agriculture information.

Kisan Suvidha - Kisan Suvidha developed to help farmers by providing relevant information to them quickly. With click of a button, they can get the information on weather of current day and next 5 days, dealers, market prices, agro advisories, plant protection, IPM Practices etc. Unique features like extreme weather alerts and market prices of commodity in nearest area and the maximum price in state as well as India have been added to empower farmers in the best possible manner.

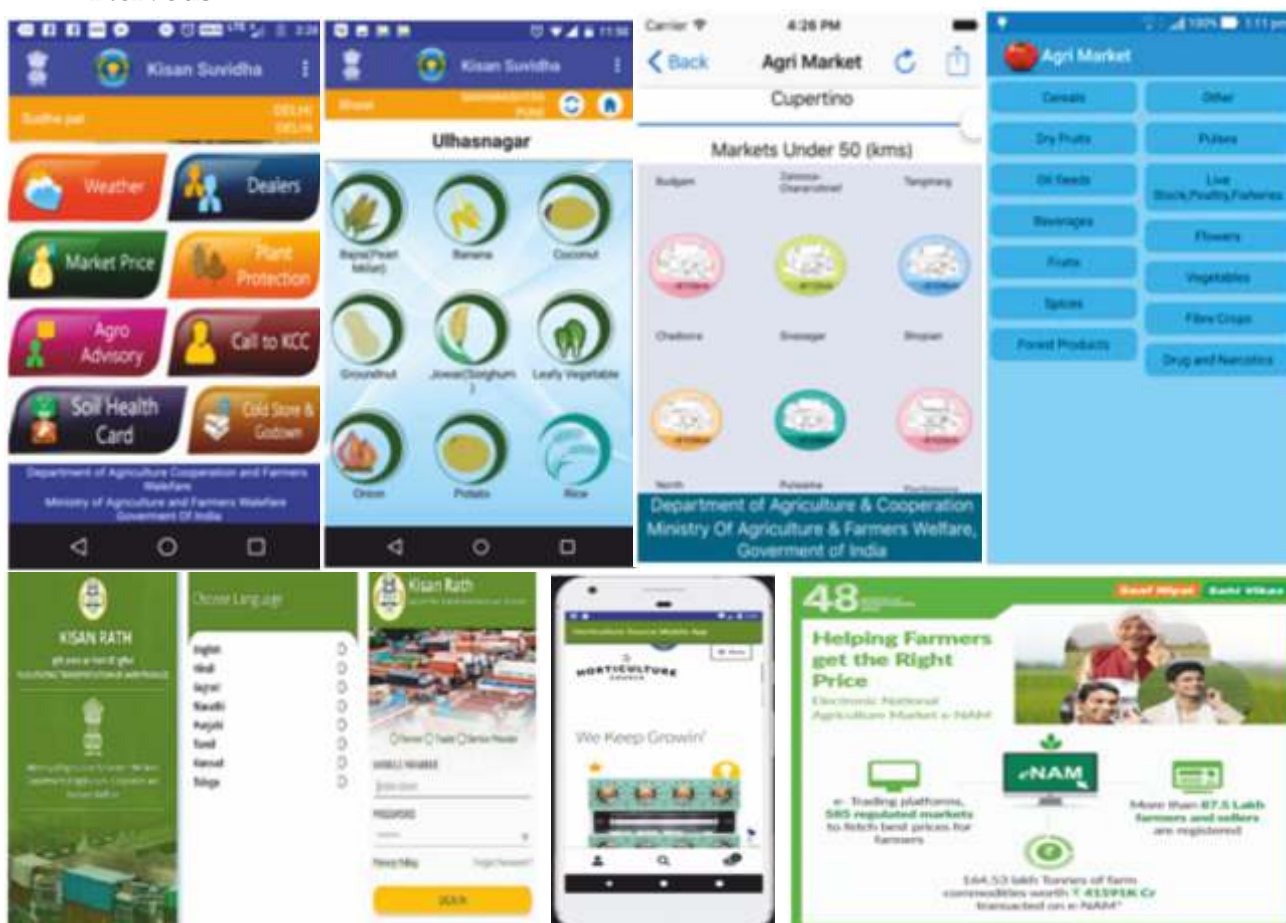
mKisan Application - It enables farmers and all other stakeholders to obtain advisories and information being sent by experts and government officials at different levels through mKisan portal without registering on the portal.

AgriMarket - AgriMarket mobile app can be used to get the market price of crops in the markets within 50 km of the device's location. This app automatically captures the location of person using mobile GPS and fetches the market price of crops in those markets which falls within the range of 50 km. There is another option to get price of any market and any crop in case person does not want to use GPS location.

- ✓ **Horticulture Apps** - Sikkim Horticulture and Cash Crop Assistance.
- ✓ **Animal Husbandry app** - Sikkim Allotment of Breeding Bull, Application for Poultry, PashuPoshan.
- ✓ **Other useful apps for farmers** - MSCS (Multi State Cooperative Societies), Digital Mandi India, Karnataka Bhoomi, HP Soil Testing, Intelligent Advisory System for Farmers, Crop Info.
- ✓ **DD-Kisan, e-Choupal, Mobile phones.**

Don'ts:

- Believe on rumors regarding agricultural market price and others
- Nervous



General precautions and safety measures in harvesting, post-harvest operations, storage and marketing of produce:

- In case of manual field operations of harvesting/ picking, accomplish the operation in 4-5feet spaced strips assigning one strip to one person. This will ensure adequate spacing between the engaged labour.
- All the persons engaged should use masks and ensure hand washing with soap at reasonable intervals.

- Maintain safe distance of 3-4 feet during rest, taking of meals, transfer of produce at collection point, loading/unloading.
- Stagger the field operations wherever possible and avoid engaging more number of persons on the same day.
- Engage only the healthy persons to the extent possible and after reasonable enquiry as to avoid the entry of any suspect or likely carrier during field activity.
- Prefer mechanized operations over the manual ones wherever feasible. Only the essential numbers of persons should be allowed to accompany the machine.
- All machines should be sanitized at the entry point and at regular intervals. All transport vehicles, gunny bags or other packaging material should also be sanitized.
- The collection of the produce may be done in small heaps spaced at 3-4 feet and field level processing should be assigned to 1-2 persons/heap to avoid crowding.
- In case the farm level storage is possible, avoid immediate rush to the market.
- Follow the standard safety measures during the visit to market for the purchase of inputs/sale of produce.

Do's and Don'ts during harvesting & threshing of crops:

- Social distancing.
- Maintaining personal hygiene by washing of hands with soap.
- Wearing of face mask.
- Protective clothing and cleaning of implements and machinery.
- Harvesting of wheat is approaching in upper northern states through combine harvesters and their movement within state and between states has been permitted although it has been harvested in many other states. Precautions and safety measures of workers engaged in repair, maintenance and harvesting operation is to be ensured.
- Mustard is the second important rabi crop, manual harvesting is done and threshing, storage and marketing to be done.
- Harvesting of lentil, maize and chilies is also done whereas storage and marketing to be done.
- Sugarcane harvesting is at peak and is also time for manual planting in the north.
- Measures of personal hygiene and social distancing to be followed by those engaged in harvesting of all field crops, fruits, vegetables, eggs and fishes before, during and after executing the field operation.
- In case of manual field operations of harvesting/ picking, accomplish the operation in 4-5 feet spaced strips assigning one strip to one person. This will ensure adequate spacing between the engaged labour.

- All the persons engaged should use masks and ensure hand washing with soap at reasonable intervals.
- Maintain safe distance of 3-4 feet during rest, taking of meals, transfer of produce at collection point, loading/unloading.
- Stagger the field operations wherever possible and avoid engaging more number of persons on the same day.
- Engage only familiar persons to the extent possible and after reasonable enquiry as to avoid the entry of any suspect or likely carrier during field activity.
- Prefer mechanized operations over the manual wherever feasible. Only the essential numbers of persons should be allowed to accompany the machine.
- All machines should be sanitized at the entry point and at regular intervals. All transport vehicles, gunny bags or other packaging material should also be sanitized.
- The collection of the produce may be done in small heaps spaced at 3-4 feet's and field level processing should be assigned to 1-2 persons/heap to avoid crowding.
- Proper sanitation and cleanliness of threshers for harvested maize and groundnut is to be maintained especially when machines are shared and used by farmer groups. Copious washing of machine parts frequently touched with soap is advised.

Do's and Don'ts during post-harvest, storage and Marketing of farm produce:

- While performing drying, threshing, winnowing, cleaning, grading, sorting and packaging operations at the farm level, wearing of protective face mask may help against aerosols and dust particles to prevent respiratory difficulties.
- Ensure proper drying prior to storage of harvested grains, millets, pulses at farm/home and do not use reuse previous seasons jute bags to prevent pest infestation. Use treated and dried gunnies after soaking in 5% neem solution.
- Adequate pre-cautions to be taken for storage of produce at the farm in jute bags that are made available in sufficient numbers to farmers or in nearby cold storages/ godowns / warehouses, if needed for better price realization.
- Adequate personal safety measures to be taken for loading and transporting of farm produce and while participating in sale at market yards/ auction platforms.
- Seed producer farmers are permitted to transport to seed companies with supporting documents and to follow precautions while receiving payment.
- Seed processing/packaging plants and transportation of seed from seed producing states to growing states (South to north) is essential to make available seed for ensuing kharif crops e.g. SSG seed for green fodder for sowing in April-May in north comes from southern states.

- Precautions to be followed for direct marketing/ supply of vegetables such as tomato, cauliflower, green leafy vegetables, cucumbers and other cucurbits from farms.
- Value addition at farm level to get better pricing and avoiding less market price due to peak season.
- Grading of agricultural output like food grains, dairy, vegetables and fruits etc. according to Directorate of Marketing and Inspection (DMI) under the Ministry of Agriculture and Farmers welfare, Government of India.

Grading -

Grading and standardization is a marketing function which adds value to a produce, as it moves along a channel.

Type of Grading -

- Domestic consumption of agricultural commodities;
- Exports of agricultural commodities; and
- Agmarking at producer's level.

Advantages of Grading:

- Facilitate good marketing
- This ensures a common trade language
- Grading widens the market
- Grading reduces the cost of marketing by minimization of expenses on the advertisement, costs due to storage losses, costs on account of personal inspection, etc.
- Ensure higher prices
- helps the consumers in getting of quality products at fair prices and hence minimize the purchasing risk of the consumers.
- Grading increases pricing efficiency through the creation of better market competition, etc.
- Grading and standardization have now assumed added importance for modern instruments of agricultural marketing such as futures/spot marketing, contract farming, retail chain linkage, export marketing etc.

Grading - Farmers' Perspective

- To get easy finance when commodities are stored;
- To get the claims settled by insurance companies;
- To get storage place for the produce;
- To get market information as per the grade of a produce.

- To pool the produce of different farmers;
- To improve the keeping quality of the stored products by removing the inferior goods from the good lots; and
- To participate in futures / spot trading of commodity tradable in the exchange platform.

Do's and Don'ts during standing field crops:

- The temperature in most of the wheat growing areas is still below long-term average and likely to delay wheat harvesting by at least 10-15 days and its beyond May 15 for some areas, therefore, farmers can delay wheat harvesting till May without incurring any significant loss, which gives enough time to manage logistics for procurement and announcement of dates.
- Rabi Paddy in grain filling stage in southern states is widely affected due to neck blast incidence, adequate pre-cautions to be taken while spraying of recommended fungicide by contract sprayers/ farmers.
- In case of any unseasonal rain at harvesting stage in paddy, spray 5% salt solution to prevent seed germination.
- In horticultural crops at fruiting stage such as mango, while carrying out field operations related to nutrient sprays and crop protection adequate precautions in handling of inputs, mixing, delivery and washing of equipment is to be undertaken.
- In summer pulses in rice fallows, whitefly management with proper safety measures may be taken up to prevent yellow mosaic virus incidence.

Rice:

Standing Rice:

- The standing rice crop reached at flowering stage, it is necessary to ensure sufficient moisture in the field and application remaining nitrogen dose.
- If second weeding is not yet done, immediately second weeding should be done.
- Harvest the boro rice at physiological maturity stage when 85% or more grains are matured. After harvesting of boro paddy, it is advised the farmers to follow proper sun drying process and then after cleaning, store the grains in dry safe place.

Pre-Kharif Rice:

- Nursery for kharif paddy is required about 800 sq. m area for raising seedlings for one-ha area. Uses fertilizer application in nursery. Seed treatment with biocontrol agent like *Pseudomonas fluoresces* followed by seedling root dip in Carbendazim/or Agrosan/Ceresan.
- For weed management, 2 manual weeding is sufficient for proper weed control but in

absence of adequate labour pre-emergence herbicides *viz.*, Pretilachlor + safener on 3rd or 4th day after sowing to control weeds in the lowland or Pre-emergence application of Butachlor or Pendimethalin must be given 1-2 days after sowing or 1-2 days after transplanting.

Maize:

Standing Maize:

- In standing maize crop application of split dose of nitrogen is necessary as it is reached to knee height stage.
- Earthing up of maize crop is also important to protect them from lodging during this stage.

Pre-Kharif Maize:

- For pre-kharif maize crop land preparation can be done by giving at least 3 deep ploughing. Followed by sowing of maize maintain appropriate spacing.
- At the time of sowing apply FYM or compost. Urea should be applied in 3 splits, mainly at sowing, knee-high and tasselling stages. Entire dose of P & K₂O with 1/3rd of urea should be applied at the time of sowing. Application of ZnSO₄ at sowing is also recommended since maize is susceptible to Zn deficiency.
- Apply pre-emergence herbicide Atrazin recommended at 2-3 days after showing to check weed growth up to 30 days.

Pre-Kharif Sesamum:

- For pre-kharif Sesamum land preparation and sowing of seeds can be done.
- Apply FYM or compost and N: P₂O₅: K₂O. Apply full P₂O₅, K₂O and 1/2 N as basal and the remaining 1/2 N at first hoeing and weeding.
- For weed management pre-emergence herbicide like pendimethalin

Pre-Kharif Moong:

- Prepare land with 2-3 deep ploughing and sow the seeds by maintain adequate spacing.
- For weed management pre-emergence herbicide like pendimethalin @ 3000 ml ha⁻¹ water.

Do's and Don'ts for Kharif crop:

- Repairment of farm implements.
- Application of manure – Green/Green/Vermicompost.
- Land preparation/soil solarization.
- Procurement of quality seed through authentic source.

- Nutrient management through soil test
- Plant protection
- Weed management
- Adopt standard POP
- Planning at farm level

Do's and don'ts for dairy farmers:

General:

- A separate set of cloth, cap, mask and shoe should be kept in the changing room or near the entrance of the farm. Before entering the farm, animal attendant should change his/her cloth, cap, mask and shoe accordingly.
- Hand should be washed thoroughly with soap or should be sanitized with sanitizer before entering dairy farm.
- Maintain a distance of 3-4 feet during rest, taking of meals, loading/unloading of feeds in sheds of organized farms.
- Entry of visitors and vehicles in to the farm complex should be strictly restricted.

Cleaning and disinfection:

- Farmer should clean the shed and animals with water and after that spray disinfectant solution.

Milking:

- Milking should be done completely one time and no milk should be retained in the mammary gland after milking. It will minimize the chances of mastitis. Make teat dip as routine practice to avoid mastitis.
- Animal attendant should wear mask while milking.

Feeding:

- Farmers are advised for regular supplementation of mineral and vitamin mixture in the feed to maintain the health and productivity of the animals.
- Apart from ad-lib dry and green grass, provide one kg concentrate feed per 2.5 l of milk production to all the milch animals. Addition of calcium supplement is helpful in maintaining milk production.
- Allow restricted free grazing for some time, if sufficient feed is not available.

Deworming & Vaccination:

- Proper deworming schedule (calf- two times within six months, and other adult animals at least two times per year) and vaccination schedule (against foot and mouth disease-

FMD, haemorrhagic septicaemia-HS and black quarter-BQ as per manufacturer guidelines) should be followed in the farm.

Do's and don'ts for Horticulture farmers:

- Preparation of nursery bed and sowing of brinjal, chilli, cabbage should be started and raised bed with appropriate size.
- Top dressing of tomato (March transplanted) can be done with urea, SSP and MOP.
- For brinjal, chilli, cabbage, cauliflower, ginger, colocasia man field should be thoroughly prepared by ploughing 4-5 times with tractor operated board plough. FYM should incorporate evenly on the soil during ploughing.

Do's and Don'ts for Poultry farmers:

General:

- Frequently clean and sanitize objects and surfaces that are touched regularly by the working staff.
- Soap, water and hand sanitizer to be kept at the entrance of the poultry shed.
- Washing of hands with soap should be carried out at regular intervals.
- Poultry farmers/ workers should use masks while working in the poultry sheds.
- Any worker who is unwell should not come to poultry shed to work.
- Proper hygiene be maintained in poultry shed and disinfection of sheds be carried out at regular intervals.
- Maintaining a distance of 3-4 feet by the workers and staff during rest, while taking meals, loading/ unloading of feeds be strictly followed.
- Personnel other than the poultry house workers should be restricted inside the poultry house.

Other guidelines:

- Feeder, waterers, filler flats, feed measuring scoops be sanitized regularly (with detergent solution).
- Different species of birds and different age group of birds should be kept separately.
- Any kind of stress to the birds should be avoided.
- A footbath with a suitable disinfectant sol. (preferably potassium permanganate) be placed at the entrance of the poultry shed and anybody entering the farm should dip his/her feet completely in the disinfectant solution.
- Separate foot-wares and dress may be used while working in the poultry shed.

Feeding:

- Birds should be provided with well-balanced ration fortified with minerals and vitamins and amino acid supplements to keep them well-nourished, healthy and in optimum production.
- All gunny bags containing feeds and medicine containers should be sanitized properly before taking it inside the farm.
- Home-made feed comprising of cooked rice, pupae meal, herbs such as celery, mint leaves and turmeric may be provided to the birds in case of non-availability of compound feeds.

Vaccination and Deworming:

- Vaccination and deworming of birds be done as per schedule.

Collection of eggs:

- Collection and storing of eggs be done hygienically.
- Fumigation of eggs for selling to be done on a regular basis.

Do's and Don'ts for Fisheries farmers:

- Fishing boats hygiene
- Equipment cleaning and sanitizing
- Pest control
- Safety of water and ice
- Prevention of cross contamination
- Clean the net, gear accessories and equipment thoroughly using clean water
- Use of hygienic fish containers or fish hold
- Transfer of fish product to a clean truck should be performed quickly.
- Restrict the timing of sale
- Seek medical care
- Restrict the entry
- Maintain the water quality and give proper nutrition

Measures required to keep the agricultural sector and supply chains working smoothly:

- The government has correctly issued lockdown guidelines that exempt farm operations and supply chains. But implementation problems leading to labour shortages and falling prices should be rectified.
- Keeping supply chains functioning well is crucial to food security. It should be noted that 2 to 3 million deaths in the Bengal famine of 1943 were due to food supply disruptions – not a lack of food availability.

- Farm populations must be protected from the coronavirus to the extent possible by testing and practicing social distancing.
- Farmers must have continued access to markets. This can be a mix of private markets and government procurement.
- Small poultry and dairy farmers need more targeted help, as their pandemic-related input supply and market-access problems are urgent.
- Farmers and agricultural workers should be included in the government's assistance package and any social protection programs addressing the crisis.
- As lockdown measures have increased, demand has risen for home delivery of groceries and E-commerce. This trend should be encouraged and promoted.
- The government should promote trade by avoiding export bans and import restrictions.

Below are some additional measures needed in addition to the government package:

- **Food and nutrition security** – ICDS, Mid-day meal, Anganwadis.
- **Cash transfers** – Jan Dhan Scheme.
- **Migrant workers** – Cash and nutritional security.

Conclusions:

- Farmers can get better price (>30% than usual) of their produce with following advisory mentioned in Do's and Don'ts in COVID period.
- With the use of ICTs farmers can develop their enterprises at higher level with increasing income.
- Sustainable/holistic development of agriculture is possible through the knowledge-based input and participation of government with farmers on time.
- Farmers prosperity can increase through timely advisory of weather and climate with assuring their produce market price.

References:

- Indian Council of Agricultural Research (ICAR) advisory for harvesting and threshing of Rabi crops and post-harvest, storage and Marketing of farm produce in the wake of COVID19 threat.
- Central Agricultural University advisories for protection against COVID19.
- ICAR-CIFT, Cochin report on Mitigation Advisories for Harvest and Post-Harvest Sector of Indian Fisheries in COVID19.
- Report of National Milk Producers Federation, 2020.

Linking Farmers to Market : Marketing of Perishable Commodities during lockdown period

B. S. Reddy and G.M. Hiremath, University of Agricultural Sciences, Raichur,
Email Id:bsreddyagecon@gmail.com, gmhiremath@gmail.com

Introduction:

Supply chains are changing rapidly, increasing transactions based on chains that involve coordinated links between farmers, traders, processors and retailers. Organizations working with farmers, Viz. NGOs and Government Extension Services (linking organizations), Private players are seeking to promote farmer welfare by using the “Linking Farmers to Markets” approach, which usually involves organizing farmers into groups to supply identified commodities to the markets. Marketing systems are undergoing rapid transformation. Traditional marketing channels with ad hoc sales are being replaced by coordinated links between farmers, processors, retailers and others. Farmer to trader linkages may simply involve working to bulk up supplies so that traders' costs can be reduced.

Linking farmers to market through involvement of Government agencies will help farming community to come out from distress sale of perishable commodities like fruits and vegetables, low price spread and higher producer share in wholesaler price realization to farmers is the need of the hour. Therefore, policy makers should give more attention on linking farmers to market through extension agencies.

Extension workers can play an important role as traders may be unable to make such arrangements on their own. Linking farmers to markets” can embrace a whole range of activities, from the very small and localized to the very large. The concept does, however, assume the development of long-term business relationships rather than support for ad hoc sales. Fruits and vegetables are perishable commodities and farmers are facing difficulties in the sale of these produce. These commodities are associated with a unique set of conditions which makes the task difficult and highly risky. During lockdown period farmers could not able to harvest his produce and bring it to market. The prolonged lockdown along with rain and hailstorm in many regions has heightened rural distress. Under these situation, Agriculture, Horticulture, Marketing Boards and State Agricultural Universities(SAU's) played major role in linking farmers to market for sale of perishable agri-horti commodities.

Problem statement and justification:

Though the fruits and vegetable producing farmers are under distress sale situation COVID19 has made them to get out from the cultivation of these crops. To encourage these farmers to continue in the cultivation business, Government of Karnataka has announced package to fruits, vegetables and flower producing farmers.

Karnataka state has a prominent position in the horticultural map of India, being the major producer of fruits and vegetables accounting 6.51 per cent of the total production in the

country. Keeping the above issues in view, the present study tries to analyse these aspects in an integrated manner. The specific objectives of the study are.

1. To identify the existing marketing channels
2. To link the farmers to markets/wholesalers
3. To compare the efficiency of existing marketing channels and
4. To work out the marketing efficiency before and during COVID19.

Fruits and vegetables are grown in almost all the states in the country under varied agro-climatic and soil conditions in plains as well as hilly areas. At present, India produces about wide variety of fruits and more than 70 different varieties of leafy, fruity and starchy tuber varieties of vegetables. The difficulties confronted in production have been compounded by the great obstacles still encountered in the marketing of agricultural commodities. The marketing of fruits and vegetables is associated with a unique set of conditions which makes the task difficult and highly risky. Firstly, the nature of produce itself; due to its high degree of perishability, it is difficult to create time and place utilities for these produce. This problem is further compounded by the poor transport and storage facilities. Secondly, the marketing of fruits and vegetables at present is mostly in the hands of a few proverbial 'middlemen' who channelize the produce from the producer to the ultimate consumer. This has an adverse effect on the prices received by the cultivators. The middlemen dominate the market and exploit the producer-seller. The profits of these men compared to the services rendered by them are outrageously high. They exploit not only the producer but also the consumer to a considerable extent because of which a "middleman" is rightly termed as 'Double-Edged Knife'.

The effort or working time of the middlemen devoted for the purpose is much smaller than that of the actual cultivator but his income, on the contrary, is much larger compared to his total investment both in terms of capital and time in the business. The investment of retailer is often next to nothing. The retailer has little or no establishment expenses. He often buys fruits and vegetables in the wholesale market on credit basis from the commission agents whom he pays late in the evening after he sells the produce to the consumers. In general there are many channels/linkages mentioned below. Among these, linkages between producer and wholesaler is commonly found during COVID19 period.

Types of market linkage

- Farmer to Domestic Trader(Wholesaler)
- Farmer to Retailer
- Linkages through a Leading Farmer
- Linkages through Cooperatives
- Farmer to Agro-Processor
- Farmer to Exporter
- Contract Farming

- A. **Farmer to Domestic Trader** : Traders have traditionally interacted with farmers on a one to-one basis, either buying from them at local markets or at the farm gate. The purchases at local markets can be relatively efficient if they enable the trader to buy sufficient quantity to achieve economies of scale with subsequent transport, which is usually the main marketing cost. Whereas, purchases at village level can often be extremely inefficient and this can contribute to the high marketing costs that often lead to allegations of exploitation of farmers by traders. Such costs can be reduced if farmers can work together to assemble all their products at one location for purchase by one or more traders.
- B. **Farmer to Retailer** : Large supermarket chains don't want to work with individual farmers on a long-term basis. Many studies conducted in India on linkages between farmer and retailers revealed that they prefer more of a transitional arrangement. The case study of linkages between one South African supermarket and a number of farmers is interesting but may not prove to be a replicable model elsewhere, given its dependence on the individual initiative of a supermarket owner. The important issues highlighted by this case study are the difficulty faced by many farmers in meeting quality specifications, even when in receipt of technical assistance from the company.
- C. **Linkages through a Leading Farmer** : Large (leading) farmers have coordinated supply from other farmers in their areas. The coordinating role of the large farmers may not be entirely altruistic; increasing quantities available for sale may open up market opportunities that would not otherwise exist. The value chain involved close liaison with input suppliers, transporters and buyers. The study conducted in developed countries revealed that coordinating role of the leading farmer appeared to be the essential component of success and eventually led to a broadening of collaborative activities to cover a wider variety of crops.
- D. **Linkages through Cooperatives** : Around the world there are notable examples of well-functioning of cooperatives marketing. The very success of this model is relatively limited number of cooperatives. Karnataka is one of the best examples, wherein Safal Market was established by NDDDB through forming 864 Safal Growers Association (SGA) in and around Bangalore (Bangalore rural, Kolar Chickballapur and Ramanagar districts of Karnataka, Theni and nearby districts of Telangana, Pulivandal and neighbouring districts of Tamil Nadu.
- E. **Linkages to Agro Processor** : One of the challenges processors facing is that investment in buildings and equipment necessitates full utilization of capacity. Processing is therefore not necessarily viable for crops that have a limited growing season, unless they can be stored for a considerable time. The example is again Karnataka, wherein Mother Dairy Fruit Processing Unit was established in the Safal Market Campus and major suppliers are Safal Growers Associations. This model is working well and hopes you have experienced Safal Fruit Juice. This processing unit is exporting Mango pulp, Guava juice, Pine apple juice, etc.

- F. **Farmers to Exporter** : Linkages developed by commercial firms would appear essential for ongoing success in high-value markets, with companies providing technical training and on-farm monitoring.
- G. **Contract Farming** : As a form of agricultural production contract farming has been practiced for many years. There are many advantages with this mode of production for companies. Linking with small farmers enables them to overcome land constraints that would be present if they attempted to produce everything themselves. It is often more efficient than plantation agriculture and certainly more politically acceptable. Offsetting this is the ever-present risk, for many crops, of extra-contractual marketing by farmers. There are also complications associated with ensuring that production is to the required standard, and in organizing the supply of inputs to farmers and the collection of outputs. In some cases contract farming companies have approached NGOs to organize farmer groups to receive inputs and collect outputs for supply to the factory.

Identifying profitable markets and linking farmers :

Activities to linking farmers to markets adopt either the “top-down” approach, which involves identifying market demand and then seeking a group of farmers to satisfy it or the “bottom-up” approach of identifying farmers to work with and then finding markets that they could supply. Whatever approach is adopted, the availability of markets is a sine qua non for successful linkage development. This may appear to be a statement of the obvious but examples are already beginning to appear of activities initiated by NGOs and others that fail for lack of a reliable and sustainable market. Markets are not enough to guarantee success. They must be capable of showing a profit for the entrepreneur who is linked to farmers and the farmers, in turn, will need to be assured of higher net incomes from entering into a new linkage than they could obtain from existing or alternative activities. At a very early stage estimates of farm profitability must be made. Such calculations should be fully costed, making realistic assumptions about production yields (i.e. using farm, not research, data) and ignoring any subsidies that the linking organization may be tempted to provide. Furthermore, it is not just sufficient to identify the market. Farmers need to be in a position to supply the market in terms of the quality required and the reliability of supply expected by the buyer. Their capacity to do this cannot be automatically assumed and will inevitably involve them in additional investments. “Linking” is thus only a small part of the task that those working with farmers have to undertake.

This study of linking farmer-to-market highlights the need for promoting entrepreneurial capabilities of farmers. This does raise the question of whether someone can be taught to be an entrepreneur or whether such capacity building can only assist those who already have an entrepreneurial instinct to become better managers. It may be unrealistic to expect people living in rural areas to suddenly become entrepreneurs. However, some linkage projects, particularly those with a “pro-poor” orientation, try to go beyond the immediate goal of improving rural incomes to that of enabling rural producers to become chain owners. This

may call for farmers to become involved in a range of value-adding activities, including produce preparation and processing, storage, transport and even, retail sale.

From the farmers' perspective, the lack of or inadequate access to production or postharvest technology; the lack of or limited access to market information and intelligence on prices and alternative buyers and farmers' own limited negotiating or bargaining skills can be considered as constraints to initiating linkages. The first step with all linkage development is to identify the type of linkage required and the level of external support that may be necessary. It is important to balance the level of support offered with the amount of assistance really required. Linkages can be jeopardized both by too little and too much support. Simple steps by farmers to improve linkages with traders by bulking up produce may require no more than someone to make the initial suggestion and act as the honest broker. An extension worker may be able to carry out this role. Furthermore, COVID19 has thought the lesson to farmers that approaching wholesaler rather than selling it to either village trader or selling through commission agent is not profitable. Farmers also realized that pre harvest contract or farm gate sale is better option to avoid the risk of arranging vehicle for transport of produce, higher commission charged by commission agent, distress sale, unforeseen expenses etc. In this regard during Third phase of lockdown Government of Karnataka has amended APMC act allowing traders to purchase produce directly from farmers. Some of the advantages and disadvantages of linkages to farmers and buyers were discussed below.

Advantages to Farmers:

- Potential advantages for farmers are for improving linkages with their buyers appear numerous.
- The buyers are prepared to supply inputs and arrange credit for the inputs. Further, in advanced contract farming schemes they may also provide mechanization services.
- Companies may provide technological and extension advice or arrange for Government extension services by linking with buyers in advance of production, farmers potentially have a more assured market and often an agreed price.
- Farmers can get the better price for their produce and reliable market at agreed price.
- Greater negotiation/bargaining power with larger quantities.

Dis-advantages to the Farmers:

- There is the possibility that the contract may break down, after considerable investment made by the farmer, as well as the potential loss of farmer flexibility in enterprise choice.
- The risk is that arrangements will collapse because of a lack of trust between the parties.
- Contractual arrangements can sometimes significantly impact on resource access.
- Farmers may need to accept short-term deferred payment and limited access to high-value markets.

- Must meet variety, quality and safety specifications and must be able to supply agreed quantities at all times. This may place farmers in conflict with social obligations.

Advantages of linkages to Buyers:

- Traders, processors, agri-food companies and large retailers can obtain more reliable and regular supply from formal or informal linkages and have a greater control over produce quality and safety.
- At the local level, small traders working with farmers to bulk-up produce can achieve scale economies and reduce costs. Purchasing from farmers in a variety of locations may also minimize production risk, especially from pest and disease.
- On a larger scale, working with smallholders is also usually more politically and socially acceptable and can sometimes be more efficient than when using a company's own farms.

Factors affecting the success of linkages:

1. Farmers can face significant problems in moving from ad-hoc sales to becoming more market-oriented. Linking organizations need to be aware of these and consider ways of addressing them;
2. The private sector must play a crucial role. There is a need to overcome the suspicion of the private sector that exists in development organizations working in developing countries; Further, Government extension agencies or other organization must have a clear capacity to develop commercial linkages.
3. Subsidies and direct provision of services, such as transport to market, are generally incompatible with commercially sustainable ventures. Interventions by Government extension agencies and line developmental department have often relied heavily on subsidies but there is scant evidence that this leads to sustainability;
4. Business relations inevitably depend on the existence of mutual trust between the parties involved and linkage activities have to pay attention to the development of such trust;
5. The organization of farmers into groups is not always essential and some groups viz. cooperatives, have a poor track record, there are strong theoretical advantages to group activities. However, there is some limited evidence regarding the types of group that have the best chance of success;
6. Contracts between farmers and buyers can be either written or oral. Contract negotiation is an important skill for farmers to develop;
7. Finance is an essential component of most linkage activities. Where this cannot be provided by the buyer, linkages to suitable financial institutions need to be developed; Therefore, linking organizations need to address sustain ability from the outset;

8. Finally, the small group of farmers who are presently benefiting from linkage activities reveals the ways in which a greater number of farmers can benefit need to be addressed.

Impact of COVID19 on marketing of fruits and vegetables: A case study of Yadgir district, Karnataka:

Immediately after the nation-wide lockdown was announced, the Government of India declared packages to protect the interest of the farmers and laborers. The impact of COVID19 on the economy is no doubt devastating. No sector has escaped its impact. Its impact on agriculture is complex and varied across diverse segments that form the agricultural value chain. The major problem faced by the agriculture sector in the lockdown is fleeing of farmers to their homes due to the fear of Coronavirus. Hence, farmers couldn't able to sale his produce. Under such circumstances, University of Agricultural Sciences, Raichur started Agri War Room to help the farmers to sale his produce ready for harvest. Among the agricultural produce, fruits and vegetable producing farmers were under distress sale situation.

Under these situations, Agricultural Extension Education Centre, Bheemarayanagudi, UAS, Raichur tried to link farmers to market. The study was confined to Yadgir district of Karnataka and both primary and secondary data were utilised in the present study. The primary data from sample farmers and market intermediaries were collected by using questionnaires prepared for the purpose.

Around 345.99 tons of fruits and vegetables sold through linking farmers to wholesalers (Market) valued Rs.36.77 lakh Table-1). Among the fruits, papaya, watermelon, muskmelon, banana and mango were the major fruit crops. Whereas, tomato, brinjal, cucumber, drumstick and curry leaf were the major vegetables sold to wholesalers.

Table-1: Sale of fruits and vegetables through linking farmers to market

Produce/commodity	Qty (Tons)	Price (Rs/kg)	Value (Lakhs)
Watermelon	173.17	4.74	8.21
Banana	5.30	6.00	0.32
Papaya	120.50	6.05	7.29
Musk Melon	1.12	22.00	0.25
Mango	23.50	76.00	17.86
Drumstick	3.65	23.00	0.84
Tomato	3.70	4.00	0.15
Brinjal	3.81	3.55	0.14
Cucumber	7.50	4.75	0.36
Curry leaf	3.70	37.00	1.37
Total Fruits	323.59	--	33.92
Total vegetables	22.37	--	2.85
Gross Total	345.99		36.77



Extension activities carried out for linking farmers to market

A systematic analysis of costs and returns of various intermediaries involved in marketing of fruits and vegetables would help to know the various services rendered by these intermediaries and their economic performances in the marketing of fruits and vegetables. The price spread is one of the measures of market efficiency as it indicates the increase in the price of a commodity as it changes hands from one intermediary to another in the marketing set up. The price spread includes marketing cost incurred and margins obtained by various market intermediaries and producers. The marketing costs and margins of different market functionaries were worked out as percentages to wholesaler's price for effective comparison during COVID19 period with pre- COVID19 period.

In general, the price spread in all the selected fruits and vegetables was found to be marginally higher in Before COVID19 period compared to COVID19 period (Table 2&3). However, the magnitude of price spread was found to be lowest in fruits (37-42%) in both the situation as compared to vegetables(43-46%) indicating higher share of producer's in consumer's price during COVID19 situation. Thus, producer's share in the price paid by the wholesalers varied marginally among different fruits and vegetables.

Table-2: Margins and price spread in marketing of fruits in the study area

Particulars	During COVID19 (Rs/Qtl)	Before COVID19 (Rs/Qtl)
1. Sale price of Farmer-Producer	870	1040
2. Cost of marketing	0	250
3. Marketing margins	510	515
4. Sale price	1380	1805
5. Price spread(%)	36.96	42.38
6. PSCR (%)	63.04	57.62

Table-3:A perusal of Table 2&3 clearly indicated that producer's share in wholesaler's rupee

Particulars	During COVID19 (Rs/Qtl)	Before COVID19 (Rs/Qtl)
1. Sale price of Farmer-Producer	4800	6550
2. Cost of marketing	0	1838
3. Marketing margins	3633	3815
4. Sale price	8433	12203
5. Price spread (%)	43.08	46.32
6. PSCR (%)	56.92	53.68

was found to be higher in fruits as compared to vegetables mainly due to higher marketing costs and margins of wholesalers. However, producer share in wholesaler's price was high during pre-COVID19 period compared to COVID19 period due to large number of middlemen involved in moving produce from producers to wholesalers.

Conclusions:

The ongoing health crisis around COVID19 has affected all walks of life. This situation thought lesson to farmers as well as other stake holders. The study clearly revealed that linking farmers to market through involvement of Government agencies will help farming community to come out from distress sale of perishable commodities like fruits and vegetables. The study also indicated that low price spread and higher producer share in wholesaler's price. Therefore, policy makers should give more attention on linking farmers to market through extension agencies.

References:

- Atibudhi, H. N., 1999, Marketing finance for vegetable crops with a special reference to marginal and small farmers in Cuttack district, Orissa. *Indian J. Agric. Mktg.*, **13** (3):98-101.
- Balappa S.R. and Hugar, L. B., 2002, Trends and variations in arrivals and prices of vegetables in Northern Karnataka. *Indian Journal of Agricultural Marketing* **16** (2):11-17.
- Reddy B. S., Rajeshwari, B.N., Goudappa, S.B. and Chandrashekhar, S.M.,2012, Market variability and price integration in major Banana markets of India. *International Research Journal of Agricultural Economics and Statistics*.**3**(2):192-196.
- Reddy, B.S., Ramappa,K.B.,Rajeshwari B. N. and Suresh S. Patil, 2014, Impact of an Innovative Market Information System for Pulses in Northern Karnataka. *Indian Journal of Marketing* **44**(8):56-65
- Singh, M., 1997, Economics of production and marketing of vegetables: A case study in Patan block of Jabalpur districts. *Agric. mktg.*, **21**(3): 18-20.
- Suleiman Abrar, Oliver, Morrissey and Tony Rayner, 2004, Crop-level supply response by agro-climatic region in Ethiopia. *J. Agri. Econ.*, **55**(2): 289-311.

Fisheries Marketing in COVID Period: Innovations & Good Practices

B. Ganesh Kumar, ICAR-National Academy of Agricultural Research Management, Hyderabad,

Email Id: ganesh@naarm.org.in

Introduction

The fishery sector is one of the fastest growing agri-sub sectors in our country, contributing over 5% in Aged and 1% in national GDP. It brings in sizeable amount of foreign exchange to the country's exchequer and provides employment opportunities to millions of people through its various main and allied activities. India is the second largest fish producer in the world with a total production of 13.7 million tonnes in 2018-19. The contribution from inland sector in the total fish production has been increasing for the past more than 3 decades and it is more than 70 per cent now. The major fish producing states are Andhra Pradesh, West Bengal, Gujarat, Kerala and Tamil Nadu. Among all, Andhra Pradesh is the leading producer from inland fishery sector and Gujarat, the leading state in marine fishery, contributing 28.45 lakh tonnes and 7.01 lakh tonnes during 2017-18 respectively.

India's seafood export at 1,377,244 tonnes earned Rs 45, 106.89 crore in 2017-18, which is about 11% of the total fish production in the country. Our major products exported are shrimp, which are mostly *Penaeus vannamei* (White leg shrimp) and *Penaeus monodon* (Black tiger shrimp) in frozen and chilled forms and our principal buyers are European Union, USA, Japan, other South East Asian nations and China. While the export sector has been receiving due attention and policy support from government through Marine Products Export Development Authority (MPEDA), the domestic marketing is mainly carried out by private players with a large number of intermediaries, who often exploit the fishermen/fish producers, thereby reducing the fisherman's share in consumer's rupee.

Meengal mobile app to facilitate home delivery of both marine and freshwater fish in Chennai and the sale volume is increasing day-by-day with the growing popularity and acceptance by the fish consuming public.

Domestic Fish Marketing in India

The fish marketing domestically is a challenging one, that is plagued with problems such as its nature of high perishability, bulkiness of material, high heterogeneity, high cost of storage and transportation, no guarantee of quality and quantity of commodity. Further, there are other inherent problems such as (i) difficulty in assembling from too many production sites; (ii) too many varieties and hence many demand pattern; (iii) wide spatial and temporal variations in market arrivals and prices; (iv) lack of information on fish price; (v) restricted entry into auctioning and wholesale trading. Now, with the establishment of National Fisheries Development Board, the government is trying to make the domestic fish marketing an efficient

one, resulting in enhanced profit to fishermen/fish producers as well as ensuring the availability of good quality fish at affordable prices to the consumers through its various initiatives and schemes.

Fish is being traditionally marketed through the channels, starting from fishermen to auctioneer to commission agent to wholesaler to retailers/hotels/street vendors/fish retail outlets to consumer in case of marine or brackish water capture fisheries sector and from fishermen/aqua culturists/fish farmers to trader/fishermen cooperative society to wholesaler to retailers/hotels/mobile vendors to consumer in case of inland or freshwater capture fisheries sector in our country.

Fish markets are in general a congested place, where in normal times during pre COVID situation, many market intermediaries at various places of fish being handled such as fishing landing sites (fishing harbour or beach landing centres), auction centres, packing or transport units, wholesale and retail markets used to carry out their activities in a crowded manner.

Post COVID Situation

Now, fishing activity has come to a grinding halt as a result the pandemic COVID19 and the resultant lock down imposed since last more than 2 months. It is understood by all now that the COVID19 has come to make the tectonic shift in all the anthropogenic and economic activities in the history of humankind as being felt in our life time and beyond. This virus has affected the livelihood of all the stakeholders of this sector (Figure 1 and 2), comprising fishermen, boat owners, share-fishers cum in multi-day trawlers, auctioneers, craft and gear mechanics, net menders, ice factory owners and so on in marine sector and aqua culturists, feed manufacturers, hatchery owners, other input suppliers, transporters/traders, labourers and others in inland sector.

COVID19 on Fish Supply and Demand

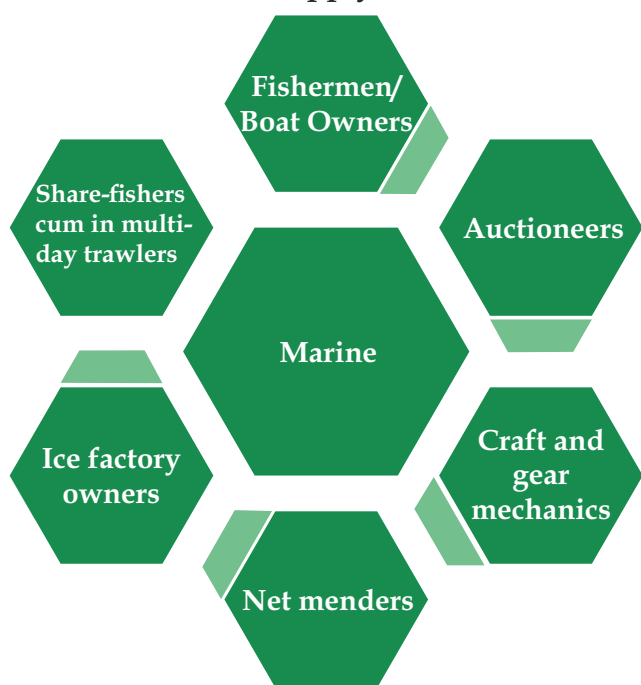


Fig 1. Major stakeholders in marine sector

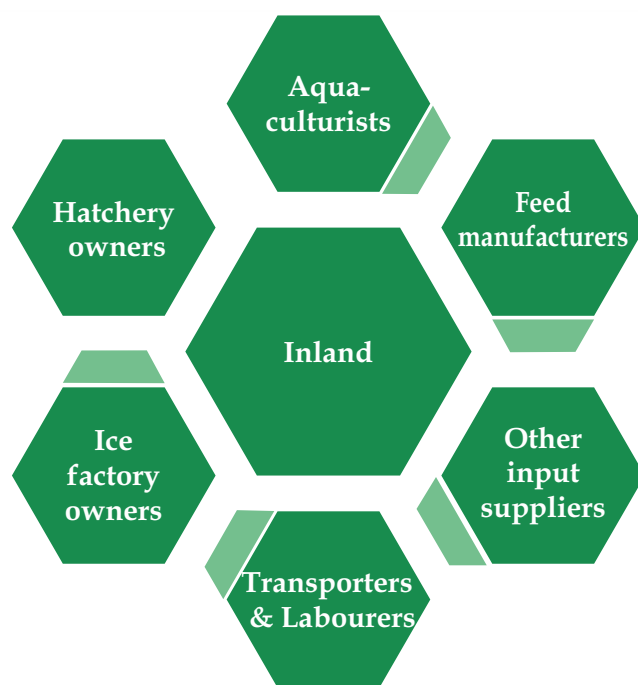


Fig 2. Major stakeholders in inland sector

Lock down has stopped all the activities and consequent movement of both fishermen as well as consumers to the market. Ironically, this single most measure has created a very unique problem, causing low fish supply and low fish demand together at a time. The fish supply has further been hit by the annual fishing ban for trawlers in our coast during this time. As a result of this, the products (more specifically fish and feed) are short in supply that should supposedly result in increase in price, But, this increase is off-set, to a certain extent, by low demand due to restrictions in movement of consumers to market and hesitation of public towards consuming seafood on account of food safety concerns.

Post COVID19 Scenario in Fisheries Sector

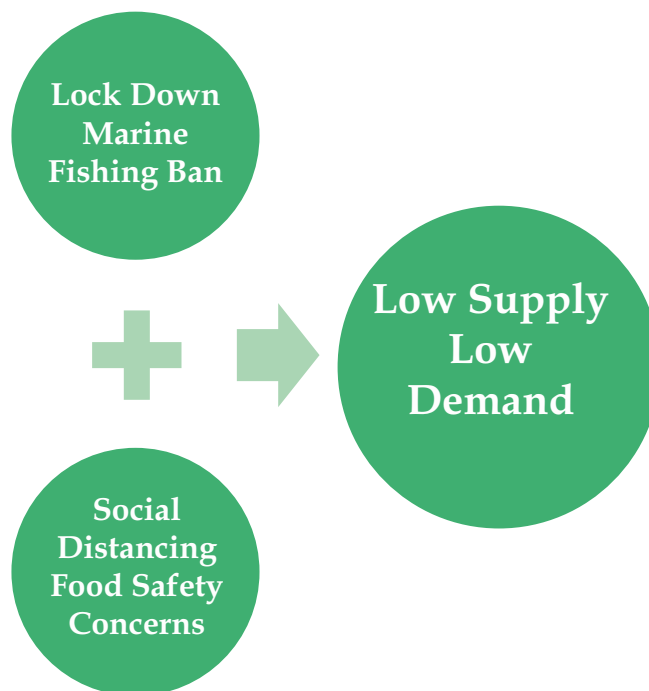


Fig 3. Fish purchase and sales nose-dived due to low supply and low demand

The prevailing situation has thrown open many different likely scenarios both in near as well as distant future. The sector is no exception to this situation. While some of the impact due to COVID19 might have been positive and unintended, such as better conservation of marine ecosystem, much of the impact is negative and long lasting.

ICAR took lead in developing and issuing advisories through the Fishery Institutions, for safety of the workers and preventing the spread of the disease in fisheries sector. In this endeavour, ICAR-Central Institute of Fisheries Technology (ICAR-CIFT), Kochi prepared advisories for the benefit of the fishermen, fishing boat owners, fishing harbour, fish market and seafood processing plants in 10 different regional languages, besides English and Hindi. ICAR-Central Inland Fisheries Research Institute (ICAR-CIFRI), Barrackpore also prepared advisories for the stakeholders involved in fishing activities in rivers, estuaries, reservoirs and wetlands (ICAR, 2020). These advisories were popularized through print & electronic media, circulated to State Fisheries Departments, developmental agencies, NGOs and SHGs, and also through social media. Such efforts have been received very well by the sector across the country (MoFAH, GoI, 2020).

Recognizing the importance of these timely advisories, the Food and Agricultural Organization (FAO), Rome has recommended these advisories prepared by ICAR-CIFT and ICAR-CIFRI by including them as Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries under the Asia-Regional initiatives for the benefit of fisheries sector across the globe(FAO, 2020).

Marine Sub-sector: Post COVID19

The lockdown has left fisherfolks in the lurch, as the prevailing situation has hindered them to undertake any fishing activity and even the catch obtained from multi-days fishing trawling were thrown into the sea at some locations in the country due to the closure of ice factories and fishing harbours, and in the absence of transportation facilities to move their cargo.

One of the likely scenarios in marine sector would be the slow resumption of fishing activity by the near shore boat operators, both manual and motorized by maintaining the physical distancing norms. The deep sea trawling activity might face unanticipated difficulty to operate on a near-normal fishing course in the immediate future even after lock down is lifted, as it requires the existence and support of fuel and human labour without any interruption.

Freshwater Aquaculture Sub-sector: Post COVID19

On an average a fleet of 200 trucks, each carrying 10 tonnes of freshwater fish from Andhra Pradesh reaches Howrah market in normal times. Only 35-40 trucks operate during this lock down period. Prices of cultured fishes have gone up by about 20-25%. Glut in domestic markets is expected after lock down period, leading to crash in prices. It remains to be seen how far the increased cost of culture due to COVID19 would be translated into the final price of fishes in terminal markets.

Brackish water Aquaculture Sub-sector: Post COVID19

Brackish water aquaculture outputs are normally meant for export market. The economic slowdown due to the pandemic in major export destinations including the US, EU, UK and China could dampen India's export performance in the days to come. China is the major export market for Gujarat and the trade was affected by January when the COVID19 virus infection affected China.

There may be an opportunity to tap the domestic market in the meantime for cultured shrimp since there is always an increasing purchasing power by the urban consumers in our country too. The price advantage of shrimp in domestic market (Rs. 300-400 per kg) over the prices of other competitive meat product such as mutton and chevon (Rs. 500-600) is another factor which might work in favour of prospective domestic urban market opportunity for shrimp.

Marketing Dynamics in Fisheries Sector: Post COVID

Having said all the above as a possible outlook on various sub-sectors within the whole fisheries sector post COVID19, the ultimate way forward and a saviour for the sector in both immediate and the long term would be to develop market, rather more precisely innovative marketing efforts to place fish at the door step of the consumers. It is seen by us in the post COVID19 situation in our country that fish consumption would have gone down significantly,

as a result of both less availability of fish in the market due to lack of transportation and closure of retail fish markets as well as lack of mobility of consuming public in the country. It is common that there would be few one or two fish markets in a town or city located far apart, while the consumers are spread across the place.

The prevailing situation is taken advantage of by the regular meat and broiler traders in some parts of the country, especially in cities and towns by delivering fresh meat at the door step of the consumers' households at the slightly enhanced price of about Rs.20-50 per kg depending upon the type of meat. Already, such a system of delivering well-cut, hygienically packaged fresh meat and even seafood through online delivery platform (mobile apps) by some of the recent start-ups operating successfully in major cities like Delhi, Mumbai, Chennai, Bengaluru, Hyderabad and Gurugram is fast emerging and expanding the business rapidly. The most notable and promising seafood delivery start-ups are Zap fresh, Tender cut and FreshtoHome which essentially source their product from farms and delivers at doorstep of the consumers after following through the standard post-harvest process and block chain technology in B2C model.

Conclusions

The fishery sector too should think of metamorphosing into this type of innovative and modern type of marketing the fish in order to sustain the fish production through both capture and culture from marine and freshwater sources in the country. Even if the lock down is lifted and the traditional fish markets slowly limp to start the business, there would still be hesitation from the fish consuming public to go to the markets physically for buying fish. So, this low-demand-for-fish scenario would continue for some more time. There lies an opportunity and potential to transform the nature and ecosystem of fish marketing in the country post COVID19.

In this regard, the KVK of ICAR-Central Marine Fisheries Research Institute, Kochi has facilitated such initiative of mobile vending the fish in the city. Similarly, Tamil Nadu Fisheries Development Corporation (TNFDC) has launched the *Meengal* mobile app to facilitate home delivery of both marine and freshwater fish in Chennai and the sale volume is increasing day-by-day with the growing popularity and acceptance by the fish consuming public. Such strategy would do good not only to enhance the fish consumption, but also ultimately result in increased and sustained fish production in the country.

References

- FAO (2020). <http://www.fao.org/3/ca8959en/ca8959en.pdf>
- ICAR (2020). <https://icar.org.in/content/cift-COVID19-advisory-fishermen>
- MoFAHD (2020). <https://pib.gov.in/PressReleasePage.aspx?PRID=1621745>
- Srivastava, R. (2020). No relief for the nowhere people. Published in The Hindu on 4 May, 2020. Available at <https://www.thehindu.com/opinion/op-ed/no-relief-for-the-nowhere-people/article31495460.ece>

Government Programmes for welfare of farming community during COVID19

Ashok Kumar, Scientist (Agronomy), ICAR- National Bureau of Soil Survey & Land Use Planning (NBSS&LUP), Regional Centre, New Delhi-110012, Delhi.

Email Id: ashok_nbss@yahoo.com

Introduction

The constitution of India in its directive principles of state policy clearly mentioned several measures to promote the welfare of society. Keeping these principles at centre stage, governments launch various schemes for the welfare of the society at large, and most of the schemes are intended to address a particular issue or sometime single scheme addressed several issues together.

Government schemes are pivotal in ensuring income and food security besides, health to vulnerable sections *i.e.*, poor farmers (marginal and small landholders) and landless labourers not only in ordinary times but in extraordinary times too. Thus, the future government schemes and programmes need to be strengthened with a view to address COVID19 like extraordinary situations, with more focus on vulnerable sections of the society.

Besides, government schemes are meant to address the problems of some focused/targeted groups or sometime to address the issues of general public at large *i.e.*, to benefit the larger population of the nation. Thus, government schemes are largely welfare oriented even in normal time but becomes paramount important in extraordinary times like what the world order is facing today particularly on account of pandemic COVID19 or Corona virus disease. In such circumstances government schemes plays a pivotal role in ensuring income and food security besides, their ensuring health security to the vulnerable sections *i.e.*, poor farmers (marginal and small landholders) and landless labourers. However, every citizen is precious to the government whether economically well off or economically marginalized one, and thus everybody comes under the ambit of govt. schemes to ensure sustainable development and economic growth. Poor sections of society are more vulnerable compare to well off sections under disaster or pandemic situation. About 85 percent famers belong to marginal and small landholding categories, and huge population being landless labourers. Therefore, govt. schemes or more aptly the welfare measures are definitely going to help them, particularly during the current crisis faced on account of COVID19 pandemic.

During such pandemic situation response of Indian government was so prompt to contain the spread of COVID19, and to save the lives of its peoples. It was in the backdrop of pandemic COVID19 situation Indian govt. declared a three-week nation-wide lockdown till mid-April in the initial phase, and has subsequently been extended till May 31st in four different lockdown periods to contain the spread of COVID19. Besides, social distancing slew of economic

measures have been announced, most notable amongst them being Rs. 1.7 trillion packages to protect the vulnerable sections (including farmers) from adverse impacts of the Corona pandemic. The main objective of this manuscript is to critically examine the validity of such schemes for farming community and economically marginalized sections of the society. Whether, these schemes are sufficient to meet the objectives of social welfare in their present state or need to be modified to tackle such extraordinary situation like what we are facing today.

Strategic moulding of various schemes by the government during COVID19 crisis to ensure welfare of the farmers and other marginalized sections:

In order to fight COVID19 pandemic and also to ease lives of the peoples of India during lock down, Honourable Prime Minister of India launched Pradhan Mantri Garib Kalyan Ann Yojana (Prime Minister's plan for well-being of the poor) aimed at providing safety nets for those badly affected by the lockdown during COVID19 pandemic. Under this scheme free food grains were provided besides, money transfer to the farmers under PM KISAN Samman Nidhi, and money transfer to women Jan Dhan Account holders. Besides, several measures to assist the agriculture sector during lockdown period included supply chain for milk, and milk products and many more items have been restored employing social distancing. Since, the pandemic was coinciding with harvesting of rabi season crops such as wheat, barley, gram and mustard, and thus the center allows normal functioning of agriculture including the harvesting of agricultural crops, horticulture, agri-procurement, mandis, repair shops, farm machinery, and custom hiring centers in rural areas. Minimum support price (MSP) operations continue to function under the crisis for food grain procurement.

During the hours of crisis umpteen numbers of operations remained suspend/postponed till further guidelines but in order to ensure food and livelihood security for the poor and marginalized sections during the COVID19 pandemic slew of measures were adopted by the government which *inter alia* includes Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) scheme to be in function even in lockdown following social distancing norms. Agricultural term and crop loans have been granted a moratorium of 3 months (till May 31) by banking institutions with 3 percent concession on the interest rate of crop loans up to Rs. 300,000 for borrowers with good repayment behaviour. Farmers allowed sell their produces beyond the designated *mandis* with the relaxation of the norms by Agricultural Produce Market Committees (APMCs). Government ministries and departments, particularly the Ministry of Agriculture & Farmers Welfare, GOI and Indian Council of Agricultural Research (ICAR) provided advisories on farm operations, besides dedicated toll-free help lines/call centers helped the farmers during the current situation. In addition to this information was also provided regarding availability of Agri-inputs.

The government of India during the lockdown made several announcement to reduce the adverse effects of COVID19 pandemic, among the measures to benefit the farmers, GOI announced front-loading of the first instalment of Rs. 2,000 under Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Scheme that is due in 2020-21 but has been paid in April 2020

itself to enable the farmers to take care of expenses related to agriculture and allied activities as well as domestic needs under the current situation of COVID19 pandemic. PM-KISAN Scheme is a central sector scheme fully funded by the government of India with a view to augment the income of farmers by providing income support to all poor farmers (marginal and small farmers having lands up to 2 hectares) *i.e.*, Rs. 6,000 each every year in 3 instalments through Direct Bank Transfer to all farmer families across the country.

Pradhan Mantri Fasal Bima Yojana (PMFBY)

PMFBY is an important government sponsored crop insurance scheme that integrates multiple stakeholders on a single platform. It was launched with the following objectives-

- To provide insurance coverage and financial support to the farmers in the event of failure of any of the notified crop as a result of natural calamities, pests and diseases.
- To stabilize the income of farmers to ensure their continuance in farming.
- To encourage farmers to adopt innovative and modern agricultural practices.
- To ensure flow of credit to the agriculture sector.

Under COVID19 like situation such scheme becomes crucial for the farmers to ensure flow of credit to the agriculture sector. However, this scheme provides insurance coverage and financial support to the farmers in the event of failure of any of the notified crop as a result of natural calamities, pests and diseases. Therefore, such schemes need to be modified keeping COVID like situation in mind *i.e.*, to say pandemic to human health may also be considered besides, natural calamities, pests and diseases for availing the benefits of scheme to all the insured farmers.

Gramin Bhandaran Yojna

The scheme was launched with the following objective-

- Create scientific storage capacity with allied facilities in rural areas.
- To meet the requirements of farmers for storing farm produce, processed farm produce and agricultural inputs.
- Promotion of grading, standardization and quality control of agricultural produce to improve their marketability.
- Prevent distress sale immediately after harvest by providing the facility of pledge financing and marketing credit by strengthening agricultural marketing infrastructure in the country.

e-National Agriculture Market (e-NAM)

e-NAM is a pan-India electronic trading portal which networks the existing APMC mandis to create a unified national market for agricultural commodities. Small Farmers Agribusiness Consortium (SFAC) is the lead agency for implementing e-NAM under the aegis of Ministry of Agriculture and Farmers' Welfare, Government of India.

Vision

To promote uniformity in agriculture marketing by streamlining of procedures across the integrated markets, removing information asymmetry between buyers and sellers and promoting real time price discovery based on actual demand and supply.

Mission

Integration of APMCs across the country through a common online market platform to facilitate pan-India trade in agriculture commodities, providing better price discovery through transparent auction process based on quality of produce along with timely online payment.

e-NAM is playing crucial role in the time of COVID19 pandemic situation due to hassle free trade through electronic platform. Trading through e-NAM platform decreases the chances of glut in the market because of information about commodity prices is available online, and it also ensures transparent auction process. Electronic mode of buying-selling, payment and price discovery reduces direct contact of buyers (traders) and sellers (farmers), and thereby helps in maintaining social distancing and resultant contain of spread of COVID19.

Digital India Programme

It is a flagship programme of the Government of India, launched in 2015 with a vision to transform India into a digitally empowered society and knowledge economy. It aims towards the promotion of digital literacy and creation of digital infrastructure for empowering rural communities. Besides, it aims to ensure that government services are available to citizens electronically and people get benefits from the latest information and communication technology.

Rupay Kisan Credit Card (RuPay KCC)

To meet the production credit requirements of the farmers in a timely and hassle-free manner, the Kisan Credit Card (KCC) has emerged as an innovative credit delivery mechanism. The National Payments Corporation of India (NPCI) has launched RuPay which is a new card payment scheme. This scheme has been conceived to fulfil RBI's vision to offer a domestic, open-loop, multilateral system which will allow all Indian banks and financial institutions in India to participate in electronic payments. RuPay is a PIN based product so it provides enhanced security. NABARD has engaged with RRBs and Cooperatives across the country and is proactive to support RuPay KCC.

Digital Agriculture

It has led to the rise and development of mobile apps which enables the government schemes, and other agriculture-based information to reach farmers in rural India.

- **Kisan Suvidha App**

Launched to work towards empowerment of farmers and development of villages. It provides information on current weather and also the forecast for the next five days, market prices of commodities/crops in the nearest town, knowledge on fertilizers, seeds, machinery etc. The option to use the app in different languages makes it more widely accessible.

- **RML KrishiMitr**

It is one of its kind agricultural app where farmers can keep up with the latest commodity and mandi prices, precise usage of pesticides and fertilizers, farm and farmer related news, weather forecast and advisory. It also provides agricultural advice and news regarding the government's agricultural policies and schemes. Users can choose from over 450 crop varieties, 1300 mandis, and 3500 weather locations across 50,000 villages and 17 states of India. Eg. Crop Doc helps the farmers in identifying problems that affects their crops at the right time and suggests corrective actions. Farm Nutri provides general and personalized nutrient recommendations, which are presented in the form of a schedule of fertilizer dosage.

- **AgriApp**

It provides complete information on crop production, crop protection and all relevant agriculture allied services. It also enables farmers to access all the information related to “High value, low product” category crops from varieties, soil/ climate, to harvesting and storage procedures. An option to chat with experts, video-based learning, the latest news, online markets for fertilizers, insecticides etc. are also available on this app.

- **m-Kisan Application**

It enables farmers and all other stakeholders to obtain advisories and information being sent by experts and government officials at different levels through mKisan portal without registering on the portal.

- **Agri Market**

Launched along with the crop insurance app by the government of India, the app has been developed with an aim to keep farmers abreast of crop prices and discourage them to go for distress sales. Farmers can get information related to prices of crops in markets within 50km of their own device location using the Agri market mobile app.

- **Kisan Rath**

The Ministry of Agriculture & Farmers Welfare has launched Kisan Rath Mobile App developed by the National Information Centre (NIC), and is available in 8 languages to facilitate transportation of food grains and perishable products during lockdown. The app is likely to connect farmers and traders to a network of more than 5 lakh trucks and 20,000 tractors, and will allow transportation of farm produce from farm gate to mandi and from one to another mandi. It will ensure supply linkages between farmers, FPOs, APMC mandis and intra-state and inter-state buyers.

The Government with a view to address the problems faced by the farmers has granted relaxation for agricultural and allied activities during nationwide lockdown. This app will be of immense use to the farming community due to its role in providing timely transportation service at competitive rates. Besides, it will ensure reduction in wastage of food and food grains, and also enable the farmers to fetch better prices for their produce.

Livestock Insurance Scheme

It aims to provide protection mechanism to the farmers and cattle rearers against any eventual loss of their animals due to death. Besides, it aims at attaining the qualitative improvement in livestock and their products. During the pandemic this scheme is of great use to the farmers and livestock rearers to cover losses related to any mishap.

General guidelines and advisories issued to contain the spread of COVID19 pandemic

DO's

- Frequent hands wash with soap and water.
- Use of alcohol-based hand sanitizer.
- Cover mouth and nose while coughing and sneezing.
- Maintain social distancing.
- Avoid touching eyes, nose and mouth.
- Use face mask.

Don'ts

- Come in close contact with someone who is displaying symptoms of corona virus disease.
- Shake hands or hug your friends and near ones.
- Go to crowded places.
- Cough or sneeze into your bare hands.
- Touch your eyes, face and nose.
- Self-medicate.
- Invite family members and friends at home.

Besides, the above general guidelines/advisories issued by the ministry of health and family welfare, Indian Council of Agricultural Research (ICAR), Ministry of Agriculture & Farmers Welfare also issued several advisories to the farmers to contain the spread of COVID19 among the farming community, since the pandemic in India coincides with the harvesting season of *rabi* crops therefore, precautions need to be taken during harvesting of grains, fruits and vegetables. The government has exempted farming operations, farm workers, custom hiring centers, mandis and procurement agencies from the lockdown rules. During the lockdown period, ICAR issued advisories to the farmers through its research institutes, KVKs network and agricultural universities so as to ensure farmers health as well as food production.

Do's for farmers during COVID19 Period

- Social distancing and safety precaution while handling farm machines and labour in the field.
- For tackling any emerging issue related to managing crops, livestock and fisheries, farmers should consult and be in touch with agri-scientists in KVKs, ICAR research institutes and state agricultural universities for timely advisories.
- Proper sanitation is advised while using shared or hired machinery for harvesting.

Don'ts for farmers during COVID19 Period

- Believe on rumors regarding agricultural information, agricultural market price and others.
- Nervous.

Atmanirbhar Bharat Abhiyaan

Honourable Prime Minister of India announced Atmanirbhar Bharat Abhiyaan as a relief measures to various sectors, affected by the COVID19 pandemic. Main aim of this package is to bring in new reforms in various public sector enterprises including mainly reforms in agriculture sector.

- NABARD will extend additional re-finance support of Rs 30,000 crore over and above the Rs 90,000 already being provided by NABARD for meeting crop loan requirement of Rural Cooperative Banks and RRBs.
- It will benefit 3 crore farmers, mostly small and marginal.

Special drive to provide concessional credit to PM-KISAN beneficiaries through Kisan Credit Cards and that will also included the fisherman and animal husbandry farmers. Besides, it will inject additional liquidity of Rs 2 lakh crore to 2.5 crore farmers.

During lockdown period

- Minimum Support Price (MSP) purchases of amount more than Rs 74,300 crores.
- PM KISAN fund Transfer of Rs 18,700 crores.
- PM Fasal Bima Yojana claim payment of Rs 6,400 crores.
- Rs 1 lakh crore Agri Infrastructure Fund for farm-gate infrastructure for farmers.
- Amendments to Essential Commodities Act to enable better price realisation for farmers
- Need to enable better price realization for farmers by attracting investments and making agriculture sector competitive.
- Agriculture Marketing Reforms to provide marketing choices to farmers.
- A Central law will be formulated to provide –
- Adequate choices to farmer to sell produce at attractive price.
- Barrier free Inter-State Trade.
- Framework for e-trading of agriculture produce..

Pradhan Mantri Jan Dhan Yojana

- It is a National Mission on Financial Inclusion that provides an integrated approach to bring about comprehensive financial inclusion and provide banking services to all households in the country.
- The scheme ensures access to a range of financial services like availability of basic savings bank account, access to need based credit, remittances facility, insurance and pension.

With the outbreak of COVID19 in India, the Finance Minister of India made an announcement to provide Rs. 500 per month to every Women Jan-Dhan Account Holders for the next three

months. This announcement was made as an initiative towards the loss caused by the outbreak.

Ayushman Bharat Yojana-PradhanMantri Jan ArogyaYojana (PMJAY)

The PMJAY popularly known as Ayushman Bharat Yojana launched in September 2018 is considered as one of the biggest healthcare schemes in the world. It is a flagship scheme of the Government of India, aimed at providing a cover of up to Rs. 5 lakhs per family per year, for secondary and tertiary care hospitalization to over 10.74 Crore poor and vulnerable families, and to cover more than 50 crore Indian citizens. It is essentially a health insurance scheme to cater to the poor, lower section of the society and the vulnerable population. Besides, it is cashless hospitalization scheme of the GOI.

Recently, Insurance Regulatory and Development Authority (IRDAI) has issued an advisory to all health and general insurance companies to cover COVID19 (Coronavirus) hospitalization and treatment costs. Thus, Ayushman Bharat Yojana Scheme covers COVID19 treatment and hospitalization as well free of cost at empanelled hospitals. Therefore, this scheme could be considered to be a boon for the larger masses of poor and vulnerable sections of the country especially under the existing situation of COVID19 pandemic.

Antyodaya Anna Yojana (AAY)

The scheme aims to target poorest of poor population and provide them relief from hunger. Households under AAY are entitled to 35 Kg of food grains per household per month. It **covers the poorest of the poor families** from amongst the Below Poverty Line (BPL) families covered under Targeted Public Distribution System (TPDS) within the States and provides them food grains at a highly subsidized rate of **Rs.1/ per kg coarse grains, Rs.2/ per kg wheat and Rs. 3/ per kg rice**. It covers landless agricultural labourers, marginal farmers, rural artisans /craftsmen etc. and the households headed by widows or terminally ill persons/disabled persons/ persons aged 60 years or more with no assured means of subsistence or societal support. The scheme targets 2.5 crore households covering **38% of BPL**.

National Food Security Mission

- It launched in 2007 for 5 years to increase production and productivity of wheat, rice and pulses on a sustainable basis so as to ensure food security of the country.
- It aims to bridge the yield gap in respect of these crops through dissemination of improved technologies and farm management practices.

Prime Minister's Citizen Assistance and Relief in Emergency Situation Fund (PM CARES Fund)

It is a public charitable trust created with the objective to meet the distressed and dreadful situation like COVID19 in times ahead.

Objectives

- To undertake and support relief or assistance of any kind relating to a public health emergency or any other kind of emergency, calamity or distress, either man-made or natural, including the creation or up gradation of healthcare or pharmaceutical

facilities, other necessary infrastructure, funding relevant research or any other type of support.

- To render financial assistance, provide grants of payments of money or take such other steps as may be deemed necessary by the Board of Trustees to the affected population.
- To undertake any other activity which is not inconsistent with the above objects.

Lessons learnt during COVID19 pandemic

The COVID19 pandemic situation has led to change in global order to the grass root level. During this crisis focus of developed world is shifted towards India on several counts, most specifically the export of medicines from India to contain the corona virus. Indian Governments efforts in containing the spread of COVID19 pandemic earned brownie points from across the world including top world organizations like world health organizations (WHO).

Media sources *viz.*, news paper and television channels reported that due to lockdown river Ganga cleaned to some extent, Himalayas become visible from cities of Punjab. Thus, lockdown *per se* should not be viewed from economic deficiency in national GDP only but it has great impact on ecological restoration, which would have otherwise, take a huge economic cost for their conservation and restoration. Therefore, it should be treated as a blessing in disguise on this count and a direct blessing to the society for saving many precious lives from the corona virus pandemic.

World has connected virtually, and rural India is not an exception to this, as the government has launched several apps for the farmers to assist them in various on farm activities as well as off farm activities. These apps informed the farmers about social distancing to buying of inputs to sell of farm produce. Besides, advisories on several events related to harvesting of agricultural crops, handling and processing of horticultural crops, animal husbandry and fishery products so as ensure proper supply of food and food products in addition to regular income.

Opportunities and challenges

The current situation of COVID19 has made us to think for evolving the possibilities of exploring new working culture *i.e.*, work from home (WFH), and is being considered as a new normal in today's context. However, it needs lots of attention from government as well as private sectors for its adoption as a common working methodology.

It has led to a global connect among the nations, and solidarity to fight against this pandemic. Globally, India's efforts to contain the spread of COVID19 are being considered as a role model for many nations to save their humanity, and economic activities particularly the agricultural sectors and pharmaceutical industry. COVID19 pandemic gives an opportunity to evolved global thinking on how to address this issue so as to save the mankind and its means to survive *i.e.*, economy. Challenge before today's global order is to survive and revive under the existing pandemic situation across the world. Human health, food and economic security pose severe challenge before the researchers and policy makers.

Conclusions

The constitution of India in its directive principles of state policy enables the governments to promote the welfare of society through various schemes which are intended to address a particular issue or sometime single scheme addresses several issues together. These schemes are launched to benefit the public at large even in normal time, and can be modified in extraordinary times or altogether fresh schemes may be announced keeping into consideration the current situation like COVID19 pandemic or Corona virus disease. World has connected virtually, and rural India is no exception to this, as the government has launched several apps for the farmers to assist them in various on farm and off farm activities.

Indian government announced slew of economic measures besides social distancing, most notable amongst them being Rs. 1.7 trillion packages to protect the vulnerable sections (including farmers) from adverse impacts of the COVID19 pandemic. World focus including world health organizations (WHO) is shifted towards India on several counts specially the pharmaceutical aid to several nations to contain the spread of corona virus besides, some other products also exported during such time. Lockdown, however, caused great economic losses to national GDP but simultaneously it saves huge economic cost on ecological conservation and restoration. In conclusion it can be said that governments schemes are pivotal in ensuring income and food security besides, health security to the vulnerable sections *i.e.*, poor farmers (marginal and small landholders) and landless labourers not only in ordinary times but in extraordinary times too. Thus, the future government schemes and programmes need to be strengthened with a view to address COVID19 like extraordinary situations, and more focus on vulnerable sections of the society.

- Acharya, S.S. and Agarwal, N.L. 1999, Agriculture Marketing in India, Oxford & IBH publishing Co. Pvt. Ltd., New Delhi
- Ashturker, B.M. and Deole, C.D. 1985 Producers' Share in Consumers Rupee: A Case Study of Fruit marketing in Marathwada, Indian Journal of Agricultural Economics, 40: 3
- Chole, V.M., Talathi, J.M. and Naik, V.G. 2003 Price Spread in Marketing of Brinjal in Maharashtra State, Agricultural Marketing, 45 (3):5-7
- K. Chand, M. B. Dastagiri, B. L. Gajja, B. L. Jangid. 2010, Price spread, marketing efficiency and constraints of carrot marketing in Rajasthan. Indian Journal of Agricultural Marketing. 24(3): 131-142.
- Neeraj, Akshay Chittora, Vinita Bisht and Vishal Johar. 2017. Marketing and Production of Fruits and Vegetables in India. Int.J.Curr.Microbiol.App.Sci. 6(9): 2896-2907.
- Usha Rani Gori, Sheela Kharkwal. 2016, A comparative study of the structure and performance of two major fruits and vegetables markets under Uttarakhand APMC. Indian Journal of Economics and Development. 4 (6): 1-15

Bibliography

- <http://www.agricultureinindia.net/marketing/direct-marketing-initiatives-for-agriculture-india/16363>
- <https://ruralmarketing.in/news/agriculture/COVID19-centre-promotes-direct-marketing-to-decongest-agri-mandis>

Direct Marketing in Agriculture

Emerging innovations in COVID Period for Fruits and Vegetables

H.M. Hiremath and B. S. Reddy, Dept. of Agri. Economics, UAS, Raichur, Karnataka,
Email Id:bsreddyagecon@gmail.com, gmhiremath@gmail.com

Introduction

The increasing trend of agricultural production has drawn the attention of marketing due to its pivotal role. In an economy like ours, production and marketing must go hand in hand. Marketing plays an important role to stimulate production and consumption and accelerates the pace of economic development of a country. The horticultural marketing in India is highly decentralized having wide capacities, but regional disparities is still there. There has been concern in recent years on the efficiency of marketing of fruits and vegetables, because of high and fluctuating consumer prices and also due to the fact that only a small share of the consumer rupee reaching the farmers. As early as 1976, National Commission on Agriculture pointed out the inefficiency in agricultural marketing with particular reference to fresh perishables and strongly recommended that, "It is not enough to produce a crop; it must be satisfactorily marketed."

Use of mobile Apps like WhatsApp groups to find the customers / consumers was common method adopted during COVID19 period. In today's world, there is a need to develop a system by the farmers like Flipkart and Amazon which are supplying the consumer goods at their door step or Swiggy and Zomato which are catering the food needs of consumers.

The, marketing of horticultural crops is complex especially because of perishability, seasonality and bulkiness. Fruits and vegetables are the items of daily consumption, and though perishable in nature, they constitute essential component of human diet. Cultivation of horticultural crops is more profitable than any other seasonal crops particularly, the food grain crops. India is one of the important fruit and vegetable producing countries in the world. In production, it ranks second after China in the case of both fruits and vegetables. India support more than 17 % of the population with only 2.4 % land share (Neeraj etal, 2017). Presently horticulture contributes 28 per cent of agricultural GDP (Gross domestic product).

Most of the horticultural commodity markets in India generally operate under the normal forces of demand and supply. The share of producer in consumer's price depends upon the type of marketing channels followed in sales transactions by the farmers. The studies conducted by Ashturker and Deole (1985), Acharya and Agarwala (1999), Chole, Talathi and Naik (2003) and Usha and Sheela (2016) indicated that the share of producers varies from 56 to 83 per cent in food grains and 79 to 95 per cent in pulses, 65-96 per cent in oilseeds and 33 to 75 per cent in case of fruit and vegetables. Government of India (2001) reported that as per survey conducted recently, the farmer is getting only one rupee out of every Rs 3.50 paid by the

consumer, the retailers is getting Rs 0.75, the wholesaler is getting Rs 0.50 and rest of the amount Rs 1.25 is going to commission agents and traders. In order to provide the remunerative prices to the farmers, there is a need to introduce innovative marketing channels like direct marketing, contract farming, etc.

Statement of the problem

In the wake of maintaining social distancing during the trade of agricultural produce amid COVID19 pandemic, the Department of Agriculture, Government of India has written to the state governments to promote 'Direct Marketing' to facilitate farmers, farmer producer organisations (FPOs) and cooperatives while selling to bulk buyers, big retailers and processors. The Centre has also issued advisories to maintain social distancing in the mandis to prevent the spread of Coronavirus. Under these circumstances, there is a need to study the direct marketing in agriculture more particularly with respect to fresh perishables like fruits and vegetables which is helpful for the producers as well as consumers.

With this backdrop, in the present paper an attempt has been made to document the successful efforts made by the Government hitherto in the field of direct marketing and to study the emerging innovations in marketing of fruits and vegetables during COVID19 period and their impact on farming community.

The concept of Direct Marketing

Direct marketing is the sale of agricultural goods and products from the farm straight to the consumer, without intervening distributors or retailers. Direct marketing can contribute toward sustainable agriculture and food systems by increasing farmer profitability, promoting the local economy, and providing consumers with higher quality and healthier products.

There are two forms of Direct Marketing, i.e., Farmers selling directly to the consumers and traders buying the produce from the doorstep of the farmers. Direct marketing enables farmers and processors and other bulk buyers to economize on transportation costs and to considerably improve price realization.

Methodology

The present paper utilizes the information collected from primary and secondary sources. The information on initiatives taken by the Government hitherto in the field of direct marketing during pre-COVID and COVID19 lockdown periods was collected through secondary sources like daily news papers and the information published by the other institutions in their websites. The primary information was also collected through rapid appraisal technique by discussing with farmers, NGO personnel and Scientists of SAUs (State Agricultural Universities).

Results and Discussion

In this section, an attempt has been made to document the successful direct marketing initiatives during pre-COVID and emerging innovations in direct marketing of fresh

perishables like fruits and vegetables during COVID19 lockdown period by the Government and institutions like SAUs, NGOs, individuals and their impact on farmers.

Direct Marketing Initiatives in India

To promote direct sales to consumers, farmers' markets have been started in the form of Gate Sales, Rural Primary Markets, Apni Mandi Initiative in Punjab, Rythu Bazar in Andhra Pradesh, Uzhavar Sandhai in Tamil Nadu, Hardaspar Vegetable Market- Pune, Shetkari Bazar in Maharashtra, KrushakBazars in Orissa, Mother Dairy Booths, Safal market, Contract Farming, National Agricultural Market and Cooperative Marketing and the details of these direct marketing initiatives are briefed as below (<http://www.agricultureinindia.net>).

Sl. No.	Initiatives	Features/Status
1.	Gate Sales	<ul style="list-style-type: none"> Farmers either sell directly by putting up a stall on the highway near their farm or establish contacts with bulk consumers such as restaurants, caterers and independent retailers to supply directly to them. The farmers who have access to direct markets, are located on highways, or have the transportation and means to supply directly to their consumers.
2.	Rural Primary Markets	<ul style="list-style-type: none"> There are many regular and periodical markets in rural and interior areas known as haats, shandies, painths and fairs. Farmers bring their produce there on fixed days of the week and sell it to consumers.
3.	Apni Mandi	<ul style="list-style-type: none"> It was started by the Punjab Mandi Board on the lines of the 'Saturday Market' in the UK and the USA. It offers farmers and growers a place in towns of Punjab and Chandigarh to sell their produce directly to consumers. It was an effort to eliminate middlemen. Apni Mandi was first established in 1987 at Mohali (Punjab) and after its success, it was introduced in 27 towns in the state.
4.	Rythu Bazaar	<ul style="list-style-type: none"> Government of Andhra Pradesh initiated on January 26, 1999. The first Rythu Bazar was established in Hyderabad. They are located on government lands identified by the District Collectors. The locations are convenient to both farmers and consumers. The criteria for opening of new Rythu Bazaars are the availability of at least one acre of land in strategic location, and identification of 250 vegetable growing farmers including 10 groups. Presently there are 106 Rythu Bazars operating in all the 23 districts of Andhra Pradesh. The prices in Rythu Bazaars are generally 25 percent above the wholesale rates and 25 percent less than the local retail price.
5.	Uzhavar Sandhai (Farmers' Markets)	<ul style="list-style-type: none"> Initiated in Nov 1999 to establish direct contacts between farmers and consumers in Tamil Nadu. Farmers' Markets are under the administrative control of the State's sixteen Agricultural Marketing Committees, which, in turn, are part of the Department of Agricultural Marketing.

6.	Hardaspur Vegetable market	<ul style="list-style-type: none"> • Hadaspar vegetable market is a model market for direct marketing of vegetables in Pune city. – • This is one of the ideal markets in the country for marketing of vegetables – The market has modern weighing machines
7.	Shetkari Bazar	<ul style="list-style-type: none"> • Established in the Maharashtra state for marketing of fruits and vegetables • It links producers and consumers directly, reduce price spread, and enhance producer share's in consumer rupee • Thus these markets increase the farm income, well being of the farmers and bring stability in prices of horticultural crops.
8.	KrushakBazars	<ul style="list-style-type: none"> • Established in the state of Orissa in 2000-01 • The purpose is to empower farmer-producer to compete effectively in the open market to get a remunerative price and ensure products at affordable prices to the consumer
9.	Mother Dairy Booths	<ul style="list-style-type: none"> • Mother dairy, basically handling milk in Delhi. But it was asked to handle retail vegetable marketing. • Mother dairy management has opened retail outlets in the city for providing vegetables to the consumers at reasonable prices.
10.	Safal market	<ul style="list-style-type: none"> • NDDDB started a fruits and vegetable unit of SAFAL at Delhi was one of the first fruit and vegetable retail chain -NDDDB has set up an alternate system of wholesale markets in Bangalore as a pilot project. • This market is a move to introduce a transparent and efficient platform for sale and purchase fruits and vegetables by connecting growers through Grower's associations
11.	Contract Farming	<ul style="list-style-type: none"> • Essentially is an agreement between farmer –producers and the agribusiness firms to produce certain pre-agreed quantity and quality of the produce a particular price and time • This is an important initiative for reducing transaction costs by establishing farmer –processor linkages. • Successful contract farming includes Organic Dyes-Marigold farmers and extraction units in Coimbatore, Pepsi Company and farmers of Punjab and Rajasthan for tomato growing.
12.	National Agricultural Market	<ul style="list-style-type: none"> • The government launched the NAM on 14 April 2016. • The NAM is a nationwide electronic trading portal comprising a network of mandis and market yards. • There are two major shortcomings of the NAM – fruits and vegetables have not been included in the NAM. Secondly, the country's two biggest mandis – Azadpur (Delhi) and Vasi (Mumbai) – have not agreed to come on board.
13.	Cooperative Marketing Society	<ul style="list-style-type: none"> • The need for cooperative marketing arose due to many defects in the private and open marketing system. • It can eliminate some or all of the intermediaries. This will make commodities cheaper and ensure good quality. • Every state has a cooperative marketing society or marketing corporations run by the state governments. • Few successful cooperative marketing societies for fruits and vegetables. e.g. Maha-grape-cooperative federation marketing, Maharashtra, Cooperative marketing pomegranate, Cooperatives marketing banana in Jalgaon district, Vegetables co-operatives in Thane District, Milk co-operatives in Maharashtra, HOPCOMS, Bangalore and Gujarat and Cooperative cotton marketing society.

Emerging Innovations in COVID19 period

In the COVID19 lockdown period, many initiatives have been introduced by the Government as well as institutions, NGOs and innovative farmers (<https://ruralmarketing.in>) are discussed in the following paragraphs.

Government Initiatives

- The Centre has asked states to allow bulk buyers, processors and big retailers for next three months to directly buy agri-produce from farmers, FPOs and cooperatives, in a bid to decongest mandis and ensure enough supply to consumption region amid COVID19 lockdown.
- Karnataka Government has exempted cooperative Institutions and FPOs in the state for engaging in wholesale trade of agricultural produce outside the market yards.
- Tamil Nadu exempted market fee on all notified agricultural produce.
- Uttar Pradesh allowed trading in e-NAM platform from farm-gate and promoted issuance of unified license to processors for direct purchase from farmers and also allowed FPOs to undertake procurement operations of wheat.
- Rajasthan allowed direct marketing by traders, processors and FPOs. In addition to that, Primary Agriculture Credit Societies (PACS)/ Large Area Multi-purpose Cooperative Societies (LAMPS) in Rajasthan have been declared as deemed markets.
- Apart from Individuals, firms, and processing units, Madhya Pradesh has allowed to set up private purchase centers outside the market-yard to purchase directly from farmers with an application fee of Rs. 500/- only.
- Himachal Pradesh, Uttarakhand and Gujarat have also allowed direct marketing without requirement of any license.
- Uttarakhand has declared warehouse, cold storage and processing plants as sub-mandis.
- Uttar Pradesh government has recently relaxed the rules and norms for declaring warehouses and cold storages as market-yards.
- Kisan Rath App facilitates the farmers and traders across the country for transportation of agri-produce by connecting them with the transporters. The app interfaces with leading transport aggregators and individual transporters for providing a wide range of transport vehicles at required date and place, in a quick and easy way. The app allows posting the requirements of part-load as well as full-load.

Impact of Government Initiatives of Direct Marketing

With the above initiatives taken by the Government, some of the visible impacts have been observed across the states.

- Rajasthan has issued more than 1,100 direct marketing licenses to processors during lockdown period wherein farmers have already started selling directly to the processors. Out of more than 550 PACS declared as market-yards in rural areas, 150

PACS have become functional for direct marketing and village traders are performing trade transactions successfully.

- Due to market fee waiver in Tamil Nadu, it was observed that traders have preferred to buy the produce from farmers from their farm-gate.
- In Uttar Pradesh, direct linkages have been established by FPOs with farmers and traders thereby supplying their produce to consumers in cities which saved wastages and directly benefitted the farmers. Further, the state has facilitated in establishing linkages with FPOs and Zomato food delivery app thereby ensuring smooth distribution of veggies to consumers.
- The Andhra Pradesh government has set up an additional 471 temporary Rythu Bazars, which are government-run vegetable markets where farmers directly sell vegetables.
- As many as 451 APSRTC buses have been converted into Mobile Rythu Bazars selling a wide range of essentials straight from the farm. This ensures that the supply of the essentials reaches even the most remote areas.
- Kisan Rath App aims to facilitate Farmers and Traders in identifying right mode of transportation for movement of farm produce ranging from food grain (cereal, coarse cereal, pulses etc), Fruits & Vegetables, oil seeds, spices, fiber crops, flowers, bamboo, log & minor forest produce, coconuts etc. Over 1.5 lakh farmers and traders registered have already installed and are using Kisan Rath App.

Initiatives by Institutions and individuals during COVID19 Lockdown period: Field Level Examples

The initiatives taken by the institutions like SAUs through their KVKs (Krishi Vigyan Kendra's) and AEECs (Agricultural Extension Education Centers), NGOs and Individuals in Karnataka were discussed as below taking into consideration the field level examples.

All the four Agricultural Universities in the Karnataka State established Agriwar rooms with toll free helpline numbers: UAS, Raichur- 1800-425-0470; UAS, Dharwad - 1800-425-1150; UAS, Bengaluru 080-23627889. The farmer producers can use these helpline numbers to get the solutions for problem srelated to agricultural production and marketing. In the first and second lockdown periods, the shops of commission agents or any middlemen in any of the agricultural markets were not open which led to two kinds of problems- one thing was farmers have left the produce in the field without harvesting and second thing was consumers were facing difficulty to get the produce. This has created an opportunity to link the producers and consumers or direct marketing of produce from producers to traders/processors/manufacturers. This may also lead to development of entrepreneurship among unemployed rural youths in the days to come.

Establishment of Agri war rooms

In the COVID19 lockdown period, Agriwar room was established with help line number by UAS, Raichur to provide solutions for the problems and to maintain data base of farmers. The agriwar room has provided technical information related to production and marketing of agri-

horti commodities as COVID19 lockdown period coincided with harvesting of rabi crops and agricultural operations to be carried out in the pre-kharif period. However, majority of the phone calls received in the agriwar room were related to marketing of crops especially fruits and vegetables. Hence, information pertaining to linking the fruits and vegetable growers to markets was provided and also facilitated in linking the farmers to markets through KVKs, AEECs and experts. Further, these institutions supported the farmers to get transportation facility to market their produce from the University as well as through Azim Premji Foundation. In the COVID19 lockdown period, the extension system of the University comprises of seven KVKs and six AEECs along with the University experts, successfully linked agricultural commodities in general and perishable fruits like water melon, pomegranate, papaya, sweet orange, mango, etc. to markets in particular.

Horticulture Club, UAS, Raichur

The Horticulture Club of UAS, Raichur also made an effort to establish direct link between producers and consumers. This club has started its activities in pre-COVID period and the same model is continued during COVID-19 lockdown period. The club has formed a Whats App group through which consumers place the orders as per the demand the club make an arrangement for the fruits from FPOs or from individual producers and all the consumers collect the fruits from the Department of Horticulture, College of Agriculture, Raichur. This is one of the successful models which brings almost 100 per cent producers share in consumer rupee as University does not collect any service charges. Though it is on smaller scale, it can be replicated to different sections of the population to scale it up.

NGO model

One of the NGO in Raichur district procures produce from the farm gate and sells directly at the door step of consumers as per their demand. Through Whatsapp group, the consumers will come to know available fruits along with price and minimum quantity one has to order in the group or through phone calls. The Whatsapp group name is Raith Setu which connects the farmers and consumers. But, now it has simplified and prepared order form through which consumers can order and at the same time NGO collects the consumer information like name, contact number, location, quantity and the nearest location of the consumers which helps in supplying the fruits to needy consumers. Hence, NGO collects service charges of 10 percent of the value of the produce from farmers to meet the operational expenses like transportation and labor charges for distribution of the fruits at the doorstep of consumers. Thus, the model helps in higher realization of prices to the producers and at the same time provide better quality produce to consumers at reasonable price.

A preliminary analysis is done for the information collected through rapid appraisal technique and the details of the same is presented in Table 1. The table reveals that in COVID19 lockdown period selling directly to consumers was more popular as most of the market functionaries and agricultural markets were not functioning. However, selling directly to local consumers was practically difficult when the produce is available in larger lots. Hence, there is

a need to depend on bulk buyers like wholesalers who can carry commodities to larger consumer markets or the processors who can change the form of the goods. In the COVID lockdown period, when the fresh fruits like watermelon, sweet orange and papaya were sold directly to consumers, the producers share in consumer rupee (PSCR) was 90 percent for all the fruits, when it was sold to wholesalers the PSCR was 56.67 per cent for papaya and it was 62.50 percent. This is in contrast to the earlier studies conducted elsewhere in India that there was a wide variation in the PSCR ranging from 33 to 75 percent for fruits and vegetables. Thus, it was clear that direct marketing is quite helpful in increasing the PSCR for fresh fruits even during COVID lockdown period.

Table 1: Benefits of NGO marketing model in COVID19 Lock down periods

Sl. No.	Particulars	Water melon	Sweet Orange	Papaya		
		Producer to Consumer	Producer to wholesalers	Producer to Consumer	Producer to Consumer	Producer to wholesalers
1	Selling price of farmers (Rs/Kg)	12.00	7.50	30.00	15	8.50
2	Marketing cost of farmers / Wholesalers (Rs / Kg)	1.20	--	3.00	1,50	--
3	Selling price of wholesalers (Rs / Kg)	--	15,00	--	--	12.00
4	Selling price of retailers (Rs/Kg)	--	20.00	--	--	15.00
5	PSCR (%)	90	62.50	90.00	90.00	56.67

In Raichur district, selling of sweet orange through Pre-Harvest Contractors was quite common and some of the innovative farmers use to sell in the Hyderabad and Bengaluru market during pre-COVID period and none of the farmers use to sell directly to consumers. But in the COVID19 lockdown period, some of the farmers followed the path of NGO model that is direct marketing method and the results are presented in Table 2. It can be observed from the table that during COVID19 lockdown period, the farmers have sold the sweet orange directly to consumers@ Rs. 30 per Kg by hiring pick up vans and labor for distribution at the consumer strategic points in the Raichur city. In the previous year that is during pre-COVID period, farmers have sold sweet orange through pre-harvest contractors and taken it to Bengaluru and Hyderabad markets. But the price realized was very low in both the channels when compared to COVID19 period. The PSCR was found to be higher in COVID period when farmers sold directly to consumers (93.33 %) compared to selling through Pre-harvest contractors and Hyderabad market (60.00%). Thus, the success of selling directly to consumers in Raichur city has boosted the confidence of the farmers and now they are willing to extend this method to other cities in the Karnataka state.

Table 2: Marketing model adopted by Innovative farmers for sweet orange during COVID and Pre-COVID periods

Sl. No.	Particulars	COVID Lockdown period (F-C)	Pre-COVID period	
			Sale through PHCs	Sale in Hyderabad Market
1	Selling price of farmers (Rs / ton)	30,000	15000	25000
2	Marketing cost of farmers/ contractors (Rs / ton)	2000	2000	2000
3	Deduction (1q / ton)	--	2500	3000
4	Commission @ 10 %	--	2500	3000
5	Sale price of retailers (Rs / ton)	--	25000	30000
6	Marketing margin of PHCs	--	3000	--
7	PSCR (%)	93.33	60.00	60.00

Conclusions

- Use of mobile Apps like WhatsApp groups to find the customers/consumers was common method adopted during COVID19 period.
- Many farmers have started their own retail outlets by obtaining pass from the Department of Agriculture or Horticulture. This has helped in understanding the consumers needs and what crops can be taken up to satisfy the needs of consumers.
- In today's world, there is a need to develop a system by the farmers like Flipkart and Amazon which are supplying the consumer goods at their door step or Swiggy and Zomato which are catering the food needs of consumers.
- The changing fruit and vegetable marketing system has given an opportunity for the FPOs and rural youths to relook into their capabilities and get ready for new emerging markets. This will not only help in eliminating the middlemen but also increase the producer share in consumer rupee and at the same time consumers also get the required items at reasonable price.
- There is a need to conduct the study to identify the feasible and sustainable models which emerged during COVID period for continuing them in post-COVID period.

References

- Acharya, S.S. and Agarwal, N.L. 1999, Agriculture Marketing in India, Oxford & IBH publishing Co. Pvt. Ltd., New Delhi
- Ashturker, B.M. and Deole, C.D. 1985 Producers' Share in Consumers Rupee: A Case Study of Fruit marketing in Marathwada, Indian Journal of Agricultural Economics, 40: 3
- Chole, V.M., Talathi, J.M. and Naik, V.G. 2003 Price Spread in Marketing of Brinjal in Maharashtra State, Agricultural Marketing, 45 (3):5-7
- K. Chand, M. B. Dastagiri, B. L. Gajja, B. L. Jangid. 2010, Price spread, marketing

efficiency and constraints of carrot marketing in Rajasthan. *Indian Journal of Agricultural Marketing*. 24(3):131-142.

- Neeraj, Akshay Chittora, Vinita Bisht and Vishal Johar. 2017. Marketing and Production of Fruits and Vegetables in India. *Int.J.Curr.Microbiol.App.Sci*. 6(9): 2896-2907.
- Usha Rani Gori, Sheela Kharkwal. 2016, A comparative study of the structure and performance of two major fruits and vegetables markets under Uttarakhand APMC. *Indian Journal of Economics and Development*. 4 (6): 1-15

Webliography

- <http://www.agricultureinindia.net/marketing/direct-marketing-initiatives-for-agriculture-india/16363>
- <https://ruralmarketing.in/news/agriculture/COVID19-centre-promotes-direct-marketing-to-decongest-agri-mandis>

Green Fodder Conservation and Marketing for Enriched Animal Diet in the Lock Down Period of COVID19

Prabha Kant Pathak, Prakash Narayan Dwivedi, Sanjay Kumar Singh,
Chandra Shekhar Sahay, Amit Kumar Patil and Bholuram Gurjar

Principal Scientist and Head, Principal Scientist Scientist, Farm Machinery & Post Harvest
Technology Division, ICAR - Indian Grassland & Fodder Research Institute, Jhansi, (UP)

Email: pkpathak65@gmail.com

Introduction

A lockdown of over a month in India aimed at stopping the coronavirus is preventing transport of not only many perishable foods but also the green fodder from the village resources to the peri urban dairies. This breakdown in the supply chain is especially hurting many rural and urban poor in the world's second-most populous country, which is facing a spike of coronavirus cases at pace. Apart from COVID19, drought, floods, earth quake, and cyclone are becoming common phenomena in India. During such natural calamities efforts has already been done for the survival of human beings and maintaining food supply chain throughout the country. However, maintaining supply chain in case of fodder during such a calamity has always been a herculean task due to poor management of forage resources and an unorganized sector of feed and fodder resource management.

Livestock sector promises hope for the marginal and landless to earn their livelihood easily. However, "food security" and 'Feed Security' are interrelated. To ensure feed security, supply of basal ration comprising of crop residues from all crops including wheat and paddy straw is to be ensured for saving of animal during adverse situation.

Tremendous amount of different varieties of crop residues and grasses are available in India for different uses like paper making, bio-energy generation, fiber extraction, briquetting etc. and could also be well utilized for animal feeding. These feed and fodder resources are either in the form of small size like wheat straw, thick stem plants like sorghum stock or in the form of whole dried crops like paddy straw or dried grasses. All of these fodder resources are highly voluminous and having lower density varying from 40-70 kg/m³ due to which their transportation, storage and handling are very cumbersome and expensive and therefore cannot be utilized up to a maximum extent. Further, the available fodders resources may also be categorized as low-grade roughage, which could be well enriched through ammoniating (liquid ammonia or urea treatment), mixing molasses or changing their physical shape and blending them with leguminous herbaceous additives for enhancing their nutritive value and digestibility as per requirement of different groups of animals.

Challenges Ahead

COVID19 poses an extraordinary challenge for India for maintaining food security for human being and feed security for livestock. India with huge population over 1.3 billion to take shelter in place for over one month during lockdown period is not only very challenging socially, economically, institutionally and politically but also affects greatly to the farmers, livestock keepers, peri-urban dairies due to dubiousness over the entire system, which disrupted on March 25, 2020 and shutting down most of the business operations, leaving people without work. The government of India announced relief package of 5 kg of rice or wheat (not milled flour) and 1 kg of pulses per month free for distribution through the Public Distribution System (PDS), which seems to be sufficient for cereal requirements and maintaining the 'Food Security' but inadequate for the requirement of the pulses with many other essential commodities like edible oil, milk, salt etc. required to make a complete diet and maintain 'Nutritional Security' too. Though there exists the world's largest food-based social program, the Public Distribution System (PDS), covering 800 million people in India to address the unique challenges from COVID19, a need is also felt to develop such a system for our 300 million bovines, 65.07 million sheep, 135.2 million goats and about 10.3 million pigs (19th Livestock Census of India, Dept. of AHD&F, Ministry of Agriculture & Farmers Welfare GOI) to provide a continuous supply of feed to not only fulfill the hunger of all livestock including stray animals but also maintain the health and productivity for sustaining the livestock and dairy sector as India continues to be the largest producer of milk in world producing 165.4 MT of milk in the year 2016-17. Hon. Prime Minister also counseled in his speech to help stray animals by feeding them during lockdown period. During such an emergency period of lockdown, India also witnessing the large-scale reverse migration towards villages has to face the toughest economic devastation in coming days and will have to search new vista to build and strengthen the rural economy. Green fodder conservation and marketing would have to provide new opportunity to develop a new business model and strengthen the rural economy and restrict the migration of rural youth at some extent. There might also be scope to strengthen the skill of farmers and promote them as 'Producer Cum Processor' in different models of 'Agro Processing' venture. This paper therefore presents briefly about scope of entrepreneurship development in green fodder conservation and marketing for enriched animal diet during lockdown period of COVID19.

Opportunities

Conserving the fodder resources scientifically, is therefore a need for animal feed sector to mitigate the losses occurred in various steps, reduce the cost of handling, storage and transportation, build up fodder reserve and serve timely the needy group in case of natural disasters, to enrich the value of roughages and strengthen the economic power of the farmers. This is possible only by “**conserving and storing**” the **locally available** crop residues, natural grasses, top feed and other available feed resources for creating '**Buffer Stock**' in different zones, rather in all the districts, of the country to feed the livestock and maintain the '**Feed**

Security' after assessing the balance sheet of fodder production in the particular zone/ district. This will not only provide the timely supply of the feed to the most affected area in the country but it will also serve as community-based '**Fodder Reserve**' or a '**Fodder Bank**' from where a needy farmer can deposit his share, withdraw as per his requirement, sale his share or even he can take loan from the bank with a promise to return with interest in term of fodder only and not in cash. It is also pertinent that the success would depend not only on conserving the crop residues but it would need to maintain the '**Nutritional Security**' for the productive animals so that the productivity of the livestock does not hamper and the dairy sector does not suffer. In this view, **there would have been proposed for a 'Fodder Reserve' or a 'Fodder Depot' or a 'Fodder Bank' to be maintained by a proposed 'Fodder Corporation of India' for maintaining the 'Buffer Stock' of feed and fodder to maintain the 'Fodder Supply Chain' not only in a normal situation but also during Natural Calamities or Pandemic Situation just like COVID19 facing by the whole world for 'Feed Security' as well as 'Nutritional Security' to the livestock.** Such a bank would have to maintain its own products in the form of densified blocks, pellets, silage and hay and if agreed by the members leguminous green fodder would also be produced and procured either for sale or conserving as raw material for adding the value to the roughages. Conservation of high-quality green fodder in the form of 'Silage', 'Leaf Meal' and 'Feed Pellets' with a complete diet formulation may additionally provide 'Nutritional Security' to the livestock and generate employment for rural youth through 'Entrepreneurship Development Programs' or 'Agribusiness Incubation Centers' or 'Skill Development Programs' and restrict their migration from the villages to metropolitan cities. Some of the new designer feed products could also be formulated based on locally available raw materials and other industrial byproducts viz. cassava byproduct, spent grains etc to enter into a successful business model. A serious and dedicated effort from all the directions starting from skill development to establish the new venture including project formulation with technical and legal guidance is however the need of the day. There exists a solution of Anna Prathavis-a-vis environmental issues caused by burning crop residues in the field too within this proposed solution. ICAR-IGFRI, Jhansi has also been experiencing the supply of densified grass bales, leaf meal and leaf meal block to the drought affected districts of Jhansi, Lalitpur, Jalaun in Bundelkhand region of Uttar Pradesh and Kosi flood affected district of Saharsa in Bihar state.

Green Fodder Conservation: The Way Forward

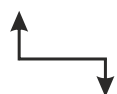
Extended use of potentially unstable material which has moisture content above 10% is possible only by reducing their moisture up to a safe level (Dry Conservation Method) for storage or by conserving them as wet material by preserving through natural fermentation in absence of air (Wet Conservation Method). Crop residues, natural grasses, leaves of leguminous fodder trees/ plants are conserved by natural sun drying in the form of hay or leaf meal and baled or densified for ease of transportation to distant areas whereas green fodder like maize, sorghum, millets, oat having sugar content are preserved as silage in bags or barrels for establishing a successful business model.

Silage Production Technology

Silage is a persevered fermented product for animal feed used during lean period and produced under anaerobic condition. Organic acid acts as preservative (Lactic acid). It is economical and practiced in intensive animal production systems to acts as complementary feed to grass for productive animals in temperate region and meet the quality fodder need during winter. It is useful when production of green fodder is high in one season and there exists acute shortage in another i.e. summer. It could also be useful, in tropics where major feed resources are crop residue/ low grade forages. It has many advantages such as lower field losses particularly of leafy portion which is relatively rich in protein and minerals; lower probability of rain damage and thus leaching of nutrients; storage over longer period under optimal ensiling conditions; provide more succulent feed to livestock; less dependence over weather conditions etc. Suitable fodder crops for ensiling are maize, sorghum, millets, oats, Perennial forages etc. For production of silage, maize and sorghum are harvested at 50% flowering to dough stage whereas oats are harvested boot to dough stage, grasses can be harvested at early flowering stage (2-3 cuts can be taken depending upon growth) and BN Hybrid and Guinea grass are harvested at about 1.5m height. Following process steps could be followed to achieve good quality silage:

Process steps: All the ensiling process as below should be completed in 3 – 5 days

Harvesting and Transportation



Chaffing → Filling → Compaction → Covering/ Sealing

- (i) Harvesting/chaffing and transportation: Many machines available to harvest green fodder stem and keep aside such as cutter bar type harvesters as well as to harvest and chaff together to upload in a trolley such as flail mower or chopper cum loader. These machines can be selected depending upon raw material, volume of work and money. If green fodder stem are harvested manually or by cutter bar type harvesters, power operated or manual chaff cutters can be selected for chopping. Chaffing favors the growth of lactic acid bacteria and improves packing.
- (ii) Filling and compaction and covering: It helps in rapid evacuation/ exclusion of air from the silo thus checks the aerobic respiration and nutrient loss. It also improves the density of fodder due to uniform size and provides proper anaerobic condition. Chopped fodder is filled in silos and compacted either manually or other means like treading by tractors so as to remove air from bulk and covered properly. When the bags are filled it may be compacted manually or mechanically and bags are stitched. Care should be taken that the chopped material is filled into the silo, layer by layer in a short span of time (1-2 days) and the crop is compacted by continuous treading to remove the inside air. The heap is then sealed quickly by covering it with polythene

sheets. The cover should be such that it prohibits the movement of air in to and from the heap and also does not allow the sun light to pass from it. This improves the heating of silo by its own temperature and speeds up the fermentation process. Temperature should be in the range of 15 to 25° C to allow growth of lactic acid producing species of bacteria and inhibiting the undesirable clostridial species. In any case, silage temperatures should not exceed 30°C over a prolonged time period, which may drastically reduce true digestibility of fresh forage protein from 90 per cent to 30 per cent or less.

(iii) Period of ensiling: Silage is ready in 45-60 days after covering

(iv) Moisture content during ensiling: 65-70% (Dry Matter: 30 - 35%)

(v) Thumb rule to observe moisture:

Have a palm full chopped material and press it in palm to form a ball. Open the palm:

- If the ball suddenly opens, moisture content is too low (>30-40%)
- If this ball remains its shape, moisture content is too high (80-85%)
- If this ball opens slowly, moisture content in fodder is suitable to be ensiled (65-70%)

(vi) Size of silo:

- Properly compacted chaffed material weighed 350 kg per cubic meter in a silo.
- For one animal @ 10 kg silage/ day would have silo of 1 m³ (1x1x1 m).
- For one animal @ 20 kg silage/ day would have a silo of 2 m³ (2x1x1 m).

(vii) Physical appearance of silage:

- Brown and greenish brown in color
- It should be fragile not clumpy
- It should have pleasant aroma of lactic acid



(viii) Indicators of silage quality:

Item	Silage Quality		
	Good	Intermediate	Poor
pH	4.2- 4.8	4.8-5.2	Above 5.2
Lactic acid %	3-14	variable	variable
Butyric acid %	Under 0.2	0.2 – 0.5	Over 0.5
Proportion of total acids %			
Lactic	Over 60	40 – 60	Under 40
Acetic	Under 25	25 – 40	Over 40
Butyric	Under 5	5 - 10	Over 10
Ammonia N(% of total N)	Under 10	10 – 16	Over 16
ADIN (% of total N)	Under 15	15 – 30	Over 30

(ix) Use of additives

- Commercial bacterial inoculants can also be used to increase the rate of lactic acid fermentation.
- Molasses can be added @5-10% depending upon the sugar content of ensiling forage.
- Whey, yeast and other energy rich ingredients, have also been used as additives to increase the fermentation and feeding value of silage.
- Addition of urea @0.5-1.0% has been found to increase CP content.

Important aspects in silage making and its removal for feeding

Utmost care to be taken in making and removing the silage as well from silo pits:

- The material to be conserved must have a high nutritive value.
- The forage must not be contaminated with soil.
- Expel the maximum amount of air within the forage before closing the silo, or sealing the bag/containers.
- All the operations from harvesting to sealing the silage in containers should be done in the shortest possible time.
- The best strategy is to make silage at different times of the year and supply it for feeding purpose after approximately 60 to 70 days of conservation.
- During feeding of the silage, minimum area should be exposed to air to avoid the spoilage.
- Covers should be kept firmly in place as long as possible.
- Top layer which came into contact with air should be discarded.

Feeding silage:

- At first instance animals may not like its taste. Provide 2 to 5 kg of silage in their ration for the first 5 to 6 days to develop the test.
- After developing the test 10 to 20 kg per head per day silage may be fed along with other fodders. It is especially suited to milch cow for producing more milk.

Strategy for making Silage and its marketing during lockdown period

At work place

- Machinery use is preferred in view of labour shortage.
- Machineries should be sanitized using 70% Alcohol to wipe down surfaces.
- Availability of water and soap at workplace is to be ensured.
- Sanitize the work place with 1% sodium hypochlorite or phenolic disinfectants.
- The guidelines of Ministry of Health & Family Welfare (GOI) for preparing fresh 1% sodium hypochlorite solution is to be followed.
- Chloroxyleneol (4.5-5.5%)/ Benzalkonium Chloride or any other disinfectants found to be effective against coronavirus may be used as per manufacturer's instructions.

- Wear disposable rubber boots, gloves (heavy duty) and a triple layer mask at work place.
- Disinfect small metallic utensils, pots and pans by boiling in water for 10 minutes.
- Chlorine bleach can be used for disinfecting the parts other than metals by immersing them in a solution of 2 table spoons of chlorine bleach per gallon of hot water for 10 minutes

Marketing

- Silage in barrels/bags could be preferred to sale in view of ease of handling.
- Barrels should be preferred for making silage in view of reusing the containers and ease of handling during marketing
- Such barrel/bag should be designed in such a way that it could be sufficient for feeding one or two animals daily. For successful marketing it should be appropriate in weight to handle and feeding livestock per day. This can be learnt from the success of marketing 'Maggi noodles.
- Barrels should be washed in a strong detergent solution using a brush and rinsing in hot water.
- Air-dry silage containers.
- Stock should be stored and maintained for at least two months so that after proper fermentation it can be ready to feed the livestock directly after approximately 60 to 70 days of conservation.
- There should be different compartments/selves/rows for storage of barrels/packets indicating day wise tagging to packaging space so that the fermented products should be identified easily and proper material can be marketed.
- A lag period of about 7 days may be taken for handling of products including their transport/dumping into the market, while designing storage space at site.
- Proper strategy should be planned for per day sale/feeding as per consumption and distance of travel by the market requirement through market survey.
- Silage in barrels/bags could be sold even on day one with proper instruction not to open before 60 days so that proper fermentation occurred.
- There is no such compulsion for silage in barrel or in bags to store them at factory site. They can be transported to far distant areas, can be stored at distributor site or at a godown in different city for a period as long as possible until and unless the storage condition in the container is not disturbed.
- For marketing the silage various e-platforms including e-NAM, KisanRath and other sites should be explored and preferred.
- Doorstep delivery, particularly for high risk groups is possible when packed in barrels.
- Have opportunity to store several months feed ration at once and also could be the preferred mode to supply to the stakeholder in view of physical distancing perspective.

Conclusion

The present COVID19 situation which may be with us for a year or more has given us a lesson that we need a 'contingency plan' focusing on how much and for what length of time we are able to supply our food to the already existing poor households and that likely to create new forced poorer group who has lost their livelihood. Perhaps, livestock sector could give the answer much better, as even a landless or marginal farmer rearing animal have the better scope to earn their livelihood easily. However, to earn the "food security" we should also think about 'Feed Security' simultaneously because both are interrelated and without animal - the real companion - we cannot think of agriculture. To ensure feed security, supply of basal ration comprising of crop residues from all crops including wheat and paddy straw is to be maintained for saving of animal life during adverse situation. A policy could therefore be made and implemented for the judicious use of all crop residues. This will also ensure the solution of many problems including *Anna Pratha* and environmental issues due to burning straw in the fields. Quality feed, not just quantity, must also be maintained to ensure 'nutritional security' and maintain our livestock productivity. To this, a variety of feed products could be processed in different forms including green fodder conservation so that it can be fed as a single complete diet to the animal. This will ensure new business models too in today's changing scenario in view to restrict rural mass migration with a slogan 'One District One Fodder Depot' (ODOFD). As in case of food supply, the fodder supply chain must also be established and gear up to deal with the transportation, storage, and distribution of large volumes of feed entity in short time frames during the lockdown or in other similar emergency situation like flood, fire, drought etc. to ensure timely supply and avoid pilferages, spoilage and contamination of feed items. Export of oil cake, bran and other feed material could also be restricted or banned by the government in such an emergency situation. In this view following recommendations are emerged:

- Government of India could think and establish 'Fodder Corporation of India' for maintaining the 'Buffer Stock' of feed and fodder to maintain the 'Fodder Supply Chain' during Natural Calamities and lean period for the livestock or Pandemic Situation just like COVID19 for 'Feed Security' as well as 'Nutritional Security' to the livestock.
- Strategies for utilization of all crop residues as animal feed and for industrial use is to be provided and policy thereof should be made and implemented ensuring the 'Feed Security' and 'Nutritional Security'.
- For a successful business model in the field of Green Fodder Conservation and Marketing and establishing proper 'Fodder Supply Chain', IGFRI, Jhansi and CCS NIAM, Jaipur has to come together.
- Designer feeds to be promoted for rural employment generation and restrict migration.

Crop Management and Hybrid Seed Production Activities in Rabi Maize: Harvest to Marketing during COVID19 Lockdown

Dr. Shyam Bir Singh

Regional Maize Research and Seed Production Centre (ICAR-IIMR), Vishnupur, Begusarai,
Email Id: pdmaize@gmail.com

Introduction

Maize (*Zea mays* L.) is one of the most versatile crops with its highest genetic yield potential among the cereals. It has diverse uses and can be grown with elevation ranging from sea level to up to 3000 amsl from Kashmir to Kanyakumari. More than 1000 products are made in India using maize. Maize is good source of carbohydrates, protein, fat, vitamins and minerals. Major share of maize grain is utilised in poultry feed (47%) followed by industrial use (14%), direct food (13%), livestock feed (13%), processed food (7%) and export (6%) (Fig 1).

The current situations of lockdown in the country due to COVID19 pandemic restricted the movement of human force in day to day activities. The major impact of COVID19 lockdown on rabi maize field operations in grain crop and seed production crop like harvesting, drying, shelling grading, packing due to non-availability of labour, machinery, other inputs, and reduced market price were reviewed to provide possible management solutions on these operations and storage of maize produce.

Majority of maize crop is cultivated during kharif season and nearly 80% kharif crop under rainfed environment. During Rabi, maize is popular in Bihar, Orissa and southern states like Andhra Pradesh, Telangana, Karnataka etc. Rabi maize grain is highly valued by industry for the grain quality due to proper grain filling and bold grain size. As per the second advance estimate during rabi season 1554 thousand ha will be under maize cultivation (Table 1). Expected production is 8219 thousand tons. In maize area, Bihar tops with 278 thousand ha representing 18% of rabi maize area, closely followed by West Bengal with 211 thousand ha (14%) and Maharashtra with 198 thousand ha (13%). Other important rabi maize growing states are Andhra Pradesh (183 thousand ha), Tamil Nadu (181 thousand ha), Telangana (163 thousand ha), Gujarat (129 thousand ha), Karnataka (87 thousand ha), Uttar Pradesh (59 thousand ha) and others (Rajasthan, Madhya Pradesh, Jharkhand, Odisha etc.). Among the main rabi maize growing states, Andhra Pradesh is having highest

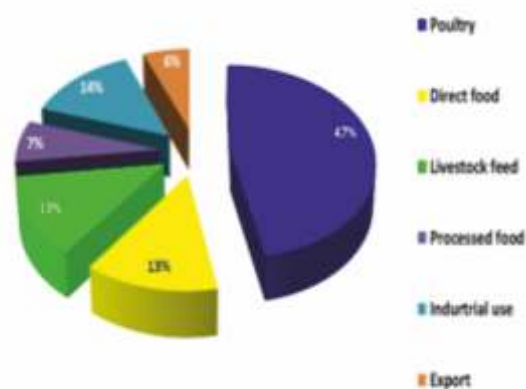


Fig. 1 Maize utilization pattern in India

productivity (7678 kg/ha) followed by Tamil Nadu (5468 kg/ha), Telangana (5383 kg/ha) and West Bengal (5158 kg/ha) (Table 1). The state of Andhra Pradesh and Telangana are the most important source of hybrid seeds, which is produced mainly during rabi season. In recent past West Bengal is also coming up as an important hybrid seed producing hub in the region (ICAR-IIMR COVID19 advisory for farmers, 2020).

Pradesh is having highest productivity (7678 kg/ha) followed by Tamil Nadu (5468 kg/ha), Telangana (5383 kg/ha) and West Bengal (5158 kg/ha) (Table 1). The state of Andhra Pradesh and Telangana are the most important source of hybrid seeds, which is produced mainly during rabi season. In recent past West Bengal is also coming up as an important hybrid seed producing hub in the region (ICAR-IIMR COVID19 advisory for farmers, 2020).

Table 1 Rabi Maize area (000 ha), average yield and stage of crop during current lockdown in third week of April in various states

State	Area	% of rabi maize area	Average state yield (kg/ha) *	Current growth stage
Bihar	278.4	17.9	3945	Grain filling
West Bengal	210.6	13.6	5158	Grain filling
Maharashtra	198.3	12.8	2332	Near harvesting
Andhra Pradesh	183.0	11.8	7678	Harvesting
Tamilnadu	180.7	11.6	5468	Harvesting
Telangana	163.0	10.5	5383	Harvesting
Gujarat	129.4	8.3	2007	Harvesting
Karnataka	87.4	5.6	3147	Near harvesting
Uttar Pradesh	59.0	3.8	4342	Grain filling
Others	64.6	4.2	2281	Grain filling/harvesting
All-India	1554.4	100.0	4160	

Source: Second advance estimate of Rabi Maize and current growth stage during 2019-20.

Impact of COVID19 lockdown on Rabi Maize and seed production crop

COVID19 emerged as a new pandemic to the entire world expecting one of the most devastating threats to human life. Due to preventive measure, government of India announced complete lockdown in the country *w.e.f.* 25th March, 2020. Initially it is imposed for three weeks but extended third time up to 17th May, 2020. During this April and May, the maize crop is in different stages. Maize being highly adaptive crop, its sowing varies from state to state. During mid-April to end of April in Southern India maize is near to harvesting, where particularly in seed production area harvesting has been stated in mid-April. On the other hand, in eastern India the crop is in grain filling stage. In Peninsular India, where the crop is in harvesting stage the lockdown will affect harvesting, drying and shelling operation partly. The seed production, processing, packing and transportation will be affected. However, since mostly the harvesting and processing operations are mechanized in nature the operations can be completed quickly. It may be noted that in many cases the seed production

and processing plants are physically separated, some cases in two states (Andhra Pradesh and Telangana). Interstate movement of seeds should not be hampered due to lockdown. Interstate movement of combined harvesters are allowed, which eases out the operation. However, since the drivers/operators of combined harvesters or seed transporting vehicles move from one state to another there will be apprehension of spread of COVID19. Where in Peninsular India maize has been cultivated as grain crop farmers are expected to face problem of drying, shelling and subsequent sale. Following are some major problems emerged due to COVID19 lockdown to manage rabi maize crop:

- Non-availability of labors for harvesting, shelling, and drying in commercial maize crop.
- Non-availability of labors for harvesting, shelling, drying cleaning, processing grading, packing *etc.*
- Non availability of combine harvesters, sheller cum dehusker, dryers to perform harvest and post-harvest operations in absence on no availability of labors.
- Restrictions on free movement of labor.
- Problem in shelling, drying and marketing due to intermittent unexpected rains if persists during May also.
- Non availability of market facility near to every maize growers/villages.
- Non availability of easy transport Transportation for carrying of maize produce to market.
- Fear among farmers not to get MSP of farmers may be forced to distress sale.
- Non-availability of sufficient storage.

Objectives of the problem

The objective of this presentation was to provide advisories to rabi maize farmers for best management of field activities during lockdown period. To deal with the problem of non-availability of labours through the use of machineries and options of mechanization available. To provide information about government initiatives for marketing of their harvested produce and also to provide storage information in case farmers want to retain their produce to avoid period of low-price market.

Strategies for augmenting COVID19 crises

Advisories/Precautions for management of Rabi Maize crop during lockdown period

Maize farmers cannot sustain without proper management of their maize crop and leaving field operations aside. Dealing efficiently with the present lockdown situation is a great challenge against the rabi maize farmers. To help farmers under this situation ICAR-Indian Institute of Maize Research, Ludhiana has issued advisories for rabi maize growers/farmers of the country. They may be grouped in two categories.

Precautions to be followed at individual farmer/labor level

- Before start harvesting operation, ensure sanitation measures like mask, sanitization of all tools/implements/machinery if these were previously used by another person.
- Start harvesting at 100% drying of husk covers and also maximum drying of stalk which result in requirement of less time and labor for cob drying.
- Do harvesting operation by maintaining required distance (minimum 3meter) from other field worker/labor.
- Try not to share your belongings/ minor tools like sickle/spades/Gamchha/drinkable and eatables without proper sanitation.
- Do not use unknown labors came from surrounding/ other districts.
- Engage only well-known local persons as labor without illness or with no symptoms like fever, nausea, cough and cold.
- Avoid working in very hot times like 11:30 AM to 3 PM.
- All farmers are also being advised not to use any smoking means/fire igniting tools nearby matured maize field which are under harvest or ready to harvest to avoid any fire instances.

Precautions to be followed by Drivers/operators of machines/combindes/Seed firms

- Mandatory quarantine of 14 days for farmers of technical/ mechanic engaged in agriculture operations cannot be afforded. Under this situation such drivers/operators of harvester/combine/dryer/ dehusker/sheller/processing machines may be allowed to work in isolation to undertake harvesting/processing operations.
- These machines with skeletal staff in batches, maintaining physical distance and proper sanitary measures.
- When seed processing and packeting are done, the seed packets may properly be fumigated before transport.
- Seed companies may be advised to ensure proper fumigation/disinfection of their machines and workers who will handle the seed packet seed godowns.
- These need to be percolated up to dealer level so that the seeds and seed packets do not become source of infection to farmers.

Initiatives to be taken by the state government

- This time north and eastern India is facing frequent untimely rain. Eastern India quite often experience untimely hail storm from April onwards, which affect standing maize crop or the harvest. Therefore, to sustain the maize crop and maize farmers following initiatives may be taken by state governments:
- Immediate measures need to be initiated to ensure crop insurance, wherever the crop is approaching grain filling or at harvesting.
- Use of combined harvesters need to be encouraged for quick harvesting of the crop to avoid harvesting like group activity.

- Facilities for community drying and shelling may be encouraged. Such dryers and shellers may be subsidized.
- Maize marketing is totally unorganized, in which the middle men and representative of feed/starch factories purchase grains from farm gate.
- Since farmers will face problem of labor in taking up post-harvest processing, they may be forced to go for distress sale. Government needs to intervene to ensure that maize grains are procured through mandies on MSP.
- Storage facility of maize may be ensured at taluka level to reduce chances of distress sale.

Use of machineries in harvesting/post harvest operations to combat shortage of labours

In India nearly 98% farmers in eastern India perform harvesting operation manually. Now machines are available to substitute the labour or reduce the requirement of labour in post-harvest operations. Dehusker cum sheller is available in which fresh harvested ears with husk cover can be put for direct shelling. There is no need to remove husk. These machines have big capacity and easily movable from one field to another as these are powered and driven by tractor. Harvested maize has high moisture content ranging 20-30%. The high moisture content in grain reduce the self or storage life of the grain and also enhanced chances of aflatoxin development. Therefore, drying in maize is very much essential to bring down the moisture content to 13% on which it can be stored. Farmers are generally practice sun drying requiring 3-5 days. But sometimes sun drying becomes difficult due to cloudy weather or intermittent rains. Under these circumstances seed dryers are the best solutions. However, these machines are not easily available in most of the area's government may take initiatives to make availability of seed dryers at panchayat or village level. Combines are very popular in maize harvesting in Punjab Haryana UP and in some areas of Bihar. Some maize farmers in Punjab also use maize combines for maize harvesting. Like wheat harvesting maize combines are perform all operations like harvesting, shelling. Farmers have no need to do harvesting and shelling operations separately. But due to high cost of the maize combines every farmers of marginal and medium farmers cannot afford maize combines. Therefore, government may provide maize combines in the maize cultivation areas on custom hiring basis.

Government initiatives for Maize marketing

Due to lockdown marketing of farmer produce become a problem to farmers. As transportation of all means were restricted but later Government has permitted all agricultural produce for transportation. Many initiatives were taken by the state governments for help of farmers. Major maize produce goes into the poultry feed industry and due to lockdown demand of poultry declined to great extent thereby decreasing demand of poultry feeds resulting less demand of maize by the poultry industries. Due to sharp decline of market rates farmers are not getting MSP even maize price in Gulab Bagh mandi in Purnea in second week of April was approximately ₹1234/ qtl against last year price of ₹1775/ qtl during same period. To safeguard the interest of farmers government has provided marketing platform for farmers like eNAM.

National Agriculture Market (eNAM) is a pan-India electronic trading portal which networks the existing APMC Mandies to create a unified national market for agricultural commodities. Small Farmers Agribusiness Consortium (SFAC) is the lead agency for implementing eNAM under the aegis of Ministry of Agriculture and Farmers' Welfare, Government of India (Anonymous 2020b). Farmer can sale their produce through eNAM portal. First, they have to register on eNAM portal through mobile and email. He will get user ID and password on successful registration. He can select APMC to sale their produce. eNAM is very helpful to farmer for marketing of their produce. Recently, on 11th May, 2020 government has added 177 new mandies on eNAM portal out of these, 26 are from Haryana, 17 are from Gujarat, one from J&K, 54 from Maharashtra, 5 from Kerala, 13 from Tamil Nadu, 15 from Odisha, 25 from Rajasthan, 17 from Punjab and one from West Bengal. Earlier Hon'ble Union Agriculture Minister Sh. Narendra Singh to mar on May 1 had launched the integration of 200 eNAM mandies from seven states, in which Karnataka was also added on eNAM to help the farmers. 785 Mandies were earlier integrated with eNAM across 17 states and 2 UTs along with a user base of 1.66 crore farmers, 71,911 commission agents, and 1.30 lakh traders. Now total 965 mandies of 18 states and three union territories are integrated on eNAM portal for wide coverage and to bring large farmers on this portal (Anonymous 2020b).

In other initiatives as an example in Andhra Pradesh over 700 new decentralised procurement centres has been set up in to support farmers amid lockdown. The state government has come up with an innovative and decentralised procurement plan to support farmers in the state during the lockdown period. These centres, set up near farmlands, are aimed to assist the government in eliminating the chances of distress selling and farmers to travel shorter distances from their farms which, in turn, will help authorities to execute the lockdown and social distancing norms.

Amid lockdown, the Andhra Pradesh government has introduced a farm gate system to procure agricultural produce directly from the doorstep of farmers at the village level. To start with, the government will be procuring paddy by agriculture assistants at the village secretariats. This system will help farmers not to carry their produce to the procurement centres and will also end the role of middlemen to a large extent (Anonymous 2020c). Telangana Government also set procurement enters in villages. Since the market yards in towns are shut, the government has opened 7,000 centres in villages to procure paddy directly from farmers. The procurement will continue till May 20 by following social distancing guidelines and other precautions. Every farmer would be issued a coupon, mentioning the date on which he will have to bring his produce to the procurement centres. After the procurement, the money will be transferred online into the farmer's bank account. The paddy cultivation was taken up on 40 lakh acres, which is a record. The government has set aside 30,000 crore to procure about 1.05 crore tonne of paddy and another 14.5 lakh tonne of maize from farmers (Anonymous 2020d).

Management at post harvest stages for Maize:

In absence of good price or MSP maize farmers can store their harvested maize grain till availability of handsome price. Postharvest handling is an important segment in the maize

value chain to minimize postharvest losses and subsequently increase farmers' income level. Postharvest involves a number of stages, which include, field drying on stalk, harvesting and stocking, transport from field, temporary storage, drying, dehusking, shelling and cleaning, storage and marketing. During postharvest, significant quality and quantitative losses occur if not handled with care. During harvesting, if incompletely matured maize is harvested, then it causes shrinkage leading to reduction in weight and quality of maize kernels, drying maize on ground greatly reduces the quality of maize through contamination and mixture with soil & other foreign matter. After drying, poor storage is another stage where maize quality and quantity losses are common if not stored properly, this comes as a result of storing maize of moisture content above 13% that cause development of fungi (mould) and also provide congenial environment for insect pest attack. Storing on bare ground and keeping storage equipment in close touch with walls allow exchange of moisture between stored maize and walls or ground. Only dry maize from the field when most of the plants have drooped should be harvested. Maize farmers should use tarpaulins where the maize is to be dried to avoid spillages and contamination with foreign matter and soils. Before storage, farmers must check the moisture content of the grain by using bottle and salt. Arrange a dry glass bottle with a cap, dry salt, a dry teaspoon, a dry plate, and grain. Grain is to be filled 1/3 of the bottle and two teaspoons of salt is added and bottle is closed tightly. Shake the bottle for one minute and let it to settle for 15 minutes. After 15 minutes, if salt sticks on the inside of the bottle then the grain moisture content is above 13% and is not ready for storage. But if the salt does not stick to inside of the bottle then the moisture content is below 13% and that would mean the grain is ready for storage (Anonymous, 2020e).

Since, due to complete lockdown in the whole country due to COVID19 and unavailability of proper market, middle men has become active and purchasing the farmers produce at very low price. In this lockdown period, maize has been harvested and farmers are struggling to get the good price. Since, poultry sector is the major consumer and accounts for around 47% of the maize produced in the country. The slump in poultry sector due to lockdown & low preference of non veg by the people is one among the major reasons for lowering the demand of the maize. So, if farmers store their grain for one or two months, then they can get the good price after the resumption of normal situation. So, it is better choice to store the maize produce for some time which can result in fetching the good price to the ultimate stakeholders.

Management of Maize Storage

In absence of good price or MSP maize farmers can store their harvested maize grain till availability of handsome price. Postharvest handling is an important segment in the maize value chain to minimize postharvest losses and subsequently increase farmers' income level. Grain storage is the major factor in deciding the entire grain marketing strategy as the market value of grain remains lowest at harvest. It makes sense for producers to store production until prices rise later in the year. Farmers are often left with no any other alternative but to go for

distress sell their produce just after harvest, even at very attractive prices which does not fulfil their cost of production. Integrated food protection measures during storage enables farmers to extend the storage period without having to take the risk of increased losses. As a result, farmers with surpluses have greater choice in selecting the appropriate date of sale, which means they can wait for periods where maize prices have reached a high level. The integrated stored-food protection has the particular advantage of using materials which are available everywhere, and of being based essentially on traditional practices. As a result, the costs are unusually low, and a high level of acceptance among farmers can be anticipated. Proper Storage of the maize produce leads to:

- Protect against rapid spoilage due to mould growth.
- Enhance self-life.
- Avoid postharvest grain losses caused by insect pests
- Most effectively market the grain.
- Avoid the distress sell.
- Get the good & genuine price.

If the farmers are intended to store the grains for long term, then they should focus on the few major points to minimize the losses during the storage:

- **Fumigated bins:** Farmers must fumigate the bins before keeping the fresh grain in the bins. Walls and floor of the bins/storage area should be painted/ white washed or sprayed with solution of deltamethrin 2.8EC@1.5ml/l of water.
- **Store quality grain (free of moulds & insect pests):** The grain to be stored must be well dried and free from the moulds & insect pests as a minute inoculum of the insect pests in the storage bin can ruin the whole grain in due course of time of storage.
- **Dry to the right moisture content:** Maize should be dried well before storage below 13 % moisture content. If the maize is not dried sufficiently, it can easily become mouldy. Drying at temperatures above 60°C causes the kernels to crack and leads to an increased risk of infestation by secondary pests. Generally, Seed can already lose its viability at a temperature of 43°C. So, sun drying is the cheap and best option to dry it. However, seed drier can also be used to dry it properly.
- **Improved aeration of bins:** Aeration of the bins time to time reduces the humidity inside the bin which reduces the chances of any insect pest infestation.
- **Control temperature:** The place, where bins are to be kept should be in the shaded area so that grain inside the bins not get exposed to the very high temperature as the temperature over 43°C not only reduces the viability of the seed (if seed is stored) but also large temperature fluctuation enhances the chances of loss of grain quality.

- **Check grain frequently:** Grain must be checked frequently for any type of insect pest infestations. If any infestation is seen, then it must be sun dried again & then after applying the insecticide, it should be stored.

Management strategies for storage pests (Lakshmi Soujanya *et al.*, 2019):

- Cleanliness and sanitation: Dusts, grain, and chaffs should be removed from transport system, storage area as well as threshing yard before using them for new produce after harvest.
- Crop should be harvested at the proper time to prevent egg laying by storage pests.
- The moisture content of grain should be less than 13%.
- Newer grains should not be mixed with older ones.
- Seed stored bags should be kept few inches above the ground.
- Walls and floor of the storage area should be painted/ white washed or sprayed with solution of deltamethrin 2.8EC@1.5ml/l of water/100sqm.
- Maize should not be kept on the cob for more than two months as this will lead to heavy insect infestation and losses.
- After 6–8 weeks, maize can be shelled, treated with insecticide & placed in bags and put back in the crib.
- Malathion 50 EC @ 15ml / 4.5 litres of water or 5% NSKE should be sprayed as a thin film on bags before use.
- Staggered sun drying with short exposure to sun spread reduces insect infestation.
- Lime dust distributed evenly in a fine coat over the stored products have Dehydrating effect on insects, blocks their respiratory orifices.
- By modified atmospheric storage, insects can be controlled by decreasing O₂ or increasing Co₂ or N₂.
- Use of plant products such as *Adathoda vasica*, *Azadirachta indica*, *Vitex negundo*, *Catharanthus roseus* @ 2% w/w (20g /kg seed) have been found to be effective against storage pests.
- Storing of maize in double layered bags is advisable. Application of leaf powder of *Tinospora cordifolia* as water-based paste between the layers of double layered storage bags provide protection against *Sitophilus Oryza* for a period of five months (LakshmiSoujanya *etal.*2018).
- Hermetic control (complete air tightness) is a simple, cheap and effective method of insect management. In this method metabolic activities of insects and microflora act as bio generators that alter the oxygen and carbon dioxide composition of the intergranular atmosphere so that insect development is arrested.
- Right execution of pre-storage activities will help farmers by reducing the risk of insect pest infestation from field to storage. Preventative measures such as right time of

harvest, maintaining optimum moisture content, sanitation in storage area, proper storage structures are essential for effective protection of maize under storage conditions. Utilization of botanicals alone and in combination with different packaging materials reduce rice weevil infestation and its associated losses. Also, application of botanicals through novel methods protects the stored grain without any adverse effects. Implementation of preventative measures and appropriate use of botanicals in hermetic storage help in strengthening food security and higher returns to small scalefarmers.

Storage methods:

The storage methods range from mud structures to modern bins. The containers are made from a variety of locally available materials differing in design, shape, size and functions. The materials used include paddy straw, wheat straw, wood, bamboo, reeds, mud, bricks, cow dung etc. Grains can be stored indoors, outdoor or at underground level. Outdoor storage of grains is done in structures made of bamboo or straw mixed with mud. For safe and scientific storage, it is important to carefully select the storage site, storage structure, undertake cleaning and fumigation, ensure proper aeration of grains followed by regular inspection of grain stock. There are many traditional methods of storage which has been depicted below through photographs.

Traditional methods:

Maize cobs, are sometimes tied in bundles, which are then suspended from tree branches, posts, or tight lines, on or inside the house. This method can only be provisional since the grain is exposed to all pests, including domestic animals, and the weather. A platform consists essentially of a number of relatively straight poles laid horizontally on a series of upright posts. If the platform is constructed inside a building, it may be raised just 35-40 cm above ground level to facilitate cleaning and inspection. Platforms in the open may be raised at least 1 metre above ground level. They are usually rectangular in shape, but circular or polygonal platforms are common. Grain is stored on platforms in heaps, in woven baskets or in bags (Fig. 2).

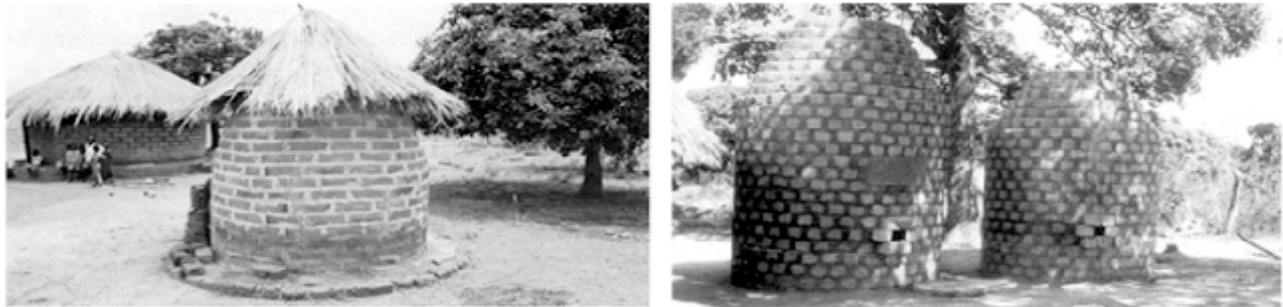
Fig. 2. Traditional methods



Brick bin storage: This type of storage is made up with the bricks on which roof tops are either made up of thatches or of RCC. The grain is kept along with the wheat straw which prevent the attack of rats as well as insect pests. These storage structures are very strong and therefore, the effect of season on them is negligible. The bin is made on a platform raised at 60 cm above the ground. A hole of about 60 cm diameter is provided on the roof for the purpose of loading the

material i.e. grains. The walls of bin are cement plastered on both the sides. The base of bin is made inclined and an outlet is provided for unloading of grains. The capacity of such bin is usually between 1.5 to 60 tonnes (Fig. 3).

Fig. 3. Brick bin storage



Ferrocement bin: The ferrocement bins are cylindrical in shape and are assembled using prefabricated components, viz, base slab, wall unit, dome shaped roofs unit and lid (Fig. 4). Bins of various capacities may be assembled by erecting one, two or three wall units, one over the other and filling up the joints. A manhole is provided in the roof unit for loading and an outlet is provided in the bottom wall unit for unloading the grain. Caskets are provided on the inlet and outlet openings to make the bins air-tight. Locking arrangements are also provided. The foundation of this bin is ideally made up of stones. It is built using chicken-wire reinforcement and cement mortar. A wooden frame built of light, straight tree branches or used wooden strips forms the shape and holds the chicken wire in place and cement mortar applied from outside. Top opening is made wide enough for a man to enter and covered with either a cone-shaped lid or chicken-wire reinforcement plastered with cement mortar lid. It is cheaper compared to steel, reinforced Concrete, aluminium and plastic bins. It also requires little or no maintenance and the condensation and moisture migration problems in the grains stored in Ferrocement bins are much less than in food grain stored in steel bins. Ferrocement bins are rodent proof, fire proof, damp proof and can be easily made air-tight by sealing the inlet and outlet openings.



Fig 4. Ferrocement Bin

Steel Bins: It is the most commonly used bin now a days which comes ready to be used and there is very less chances of insect pest infestation if it has been used after proper fumigation. The condensation and moisture migration problems in the grains stored in steel bins are higher than in food grain stored in ferrocement bins. Maintenance on steel bins is minimal, ensuring they are cleaned when emptied and inspected for insects, corrosion, loose bolts, foundation cracks and poor seals.

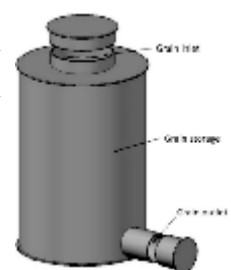


Fig. 5. Steel bins

Bulk Silo storage

Technological advancement is now playing a vital role in stimulating growth with vertical scientific storage structures gradually replacing the traditional horizontal flat-bed warehouses for agricultural storage. NCML has constructed modern Silo complex of 36000 MTs capacity

duly equipped with facilities like Dryer and Chiller for safe and efficient preservation of Maize at Purnea, Bihar. In this structure, the grains in bulk are unloaded on the conveyor belts and, through mechanical operations, are carried to the storage structure. Silo is a vertical tank like structure made of steel for bulk storage of food grains in controlled atmosphere. Silos offer several advantages depending upon their layout and automation. Silos require 1/3rd of the land as compared to conventional warehouses. The storage of grain in a silo is possible for long periods without quality loss or damage through various biotic and abiotic factors. If food grains are stored in silos and transported in bulk, losses due to theft, pilferage and transportation would be negligible compared to food grains storage in bags in conventional warehouses. Because of mechanisation, silos require less labour in operations, handling is rapid and the overall operating cost low. Being a closed structure, preservation of maize in a silo through chilling technique can be carried out more easily, efficiently and effectively. Lately Chilling technique is gradually becoming more popular method of grain preservation in sub-tropical countries like India over traditional method of grain preservation which essentially include periodic aeration coupled with fumigation as it is not only cost effective but is more safe, easier and efficient way of grain preservation. Further, it also supports storage of Maize in bulk storage with grain moisture up to 14.5% as against the requirement of 12% (required when stored in bulk). Silos having Drier facility can effectively address the issue of handling large volumes of high moisture grain received from the farm gate during the harvest period which usual extends up to a period of 45-60 days (FICCI report, 2018).

Conclusions

Impact of COVID19 lockdown on rabi maize crop harvesting and post harvesting operations was analysed in the webinar. All maize rabi maize farmers, drivers, mechanics/operators were advised to work with following COVID19 isolation guidelines. Advisories regarding harvesting and post harvesting operations like shelling, drying, of commercial grain crop and processing, grading packing storage of grain as well as seed produced were given. Emphasis was given on the use of modern technologies and mechanizations like seed dryers, maize harvester and modern bulk silo storage in absence of labours and due to unpredicted climatic situations like unexpected rains at harvest. Problem of maize marketing was discussed advising farmers to use eNAM portal for marketing. Examples of Andhra Pradesh and Telangana for direct procurement of maize and other crops on MSP needs to replicated in other states aimed to eliminating the chances of distress selling, avoid farmers long distance travel, to safeguards the interest of maize farmers and ensure good returns to them.

References

1. Anonymous, 2020a. <https://enam.gov.in/web/trading-details> accessed on 10-05-2020.
2. Anonymous, 2020b. <https://www.jagranjosh.com/current-affairs/177-new-mandis-integrated-with-enam-platform-1589261900-1> accessed on 10-05-2020 accessed on 10-05-2020.

3. Anonymous 2020c <https://www.financialexpress.com/market/andhra-pradesh-govt-to-now-procure-produce-directly-from-farmers/1929511/> accessed on 10-05-2020
4. Anonymous. 2020d. <https://telanganatoday.com/over-700-new-decentralised-procurement-centres-in-andhra-pradesh> accessed on 10-05-2020.
5. Anonymous, 2020e. Kabarole Research & Resource Centre. Retrieved through <https://krcuganda.org/%E2%80%A2maize-post-harvest-handling-comes-of-age-quality-at-center-stage/>.
6. FICCI 2018. Maize vision 2022, A Knowledge Report. Pricewater house Coopers Private Limited.
7. ICAR-IIMR advisory on COVID19 to maize farmers issued on 10-04-2020.
8. Lakshmi Soujanya P, Sekhar JC, Suby SB, Rakshit S, Susmitha GS, Mallavadhani UV. 2018. Biopesticide treated double layered bags: Novel method of application of botanicals for *Sitophilus oryzae*. L. management in stored maize. *Maydica*. 63 (1): 1-6.
9. Lakshmi Soujanya P, Sekhar JC, Suby SB, Reddy ML, Rakshit S. 2019. Stored grain pests of maize & their management. A compendium on Model training course on maize production technology and management strategies for Fall Armyworm. 173-178.

Team



Mr. Manoj Kumar
Agrawal
Chief Operating Officer,
NABI, CCS NIAM



Dr. Mahesh Kadam
Manager-Marketing &
Communication,
NABI, CCS NIAM



Mr. Karthik Sekar
Consultant,
NABI, CCS NIAM



Mr. Akshay Singh
Ranawat
Legal Executive,
NABI, CCS NIAM



Mr. Abhishek Sharma
Manager-Finance & ICT,
NABI, CCS NIAM



Mr. Rahul Sankhala
Content Developer,
NABI, CCS NIAM



Mr. Sachin Ukey
Business Executive,
NABI, CCS NIAM



Ms. Aishwarya Wasnik
Business Executive,
NABI, CCS NIAM



Mr. Ashutosh Vyas
Business Executive,
NABI, CCS NIAM



Mr. Mayur Verma
Library Assistant,
CCS NIAM



Dr. Yogesh Sharma
Library Consultant,
CCS NIAM



Mr. NVS Prasad
IT Facilitator, CCS NIAM

