



# Impact Assessment of Indian Precision Agriculture & Plasticulture Sector Post COVID-19



**National Committee on Precision Agriculture & Horticulture (NCPAH)**  
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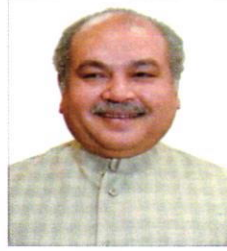
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### FOREWORD

The pandemic of COVID-19 has devastated the socio-economic fabric of the world. The lockdown did not have any negative impact on agricultural production but it exposed the weaknesses of labour markets and agri-food supply chains that may hold the promise of evolving into new vistas for farming and farmers ex-post the COVID-19 pandemic. There is no denying the fact that the lockdowns saved millions of lives, but the stoppage of economic activities adversely affected the livelihoods of millions, especially in the developing countries.

The agricultural sector being the backbone of the country witnessed historical rate of growth, i.e., about 3%, in 2019-20. In fact, during January-March 2020, it recorded a substantially higher growth of 5.87% as compared to the overall economic growth of 3.04%. The predictions of a normal monsoon have further infused confidence among policy makers and hopes of achieving the growth target of 3%. These trends suggest that agriculture is resilient to transient shocks, as of lockdown, and has the potential to revive the overall economic growth via its strong backward and forward as well as inter-sectoral linkages.

Precision farming & Plastics application industry with its established footprints have also suffered to this very effect imposed by the COVID-19 during last two years. I, on-behalf of National Committee on Precision Agriculture & Horticulture (NCPAH) am happy to place this report to all the policy makers, industry leaders, prospective readers, academicians and agri- frontiers prepared by team NCPAH highlighting status of Indian precision farming and plastics sector during covid times.

It is a delight to note that 22 Precision Farming Development Centres (PFDCs) established under this department monitored by NCPAH under the leadership of Dr. S K Malhotra (Ex. MS, NCPAH), presently led by Dr. Prabhat Kumar (MS, NCPAH & Horticulture Commissioner), have contributed significantly to Indian agriculture under the GoI flagship schemes.

The respondent growers adopted these water saving techniques with assistance from GoI programs and have upscaled the production and productivity despite of vagaries of climate and pandemic.

I am grateful to all the stakeholders covered in this assessment report who actively participated and responded to team NCPAH in preparing this report titled "*Impact Assessment of Indian Precision Agriculture & Plastics Sector post Covid 19*".

The report provides a road map to deliberate on the gap areas and to dwell on future strategies for betterment of the sector & industry reforms keeping farmers as ultimate beneficiary and for achieving the goals under GoI schemes.

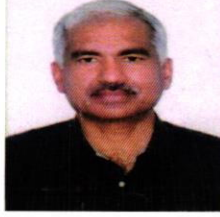
(Narender Singh Tomar)



**MANOJ AHUJA**  
**SECRETARY**



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



### **MESSAGE**

COVID-19 pandemic has led to many challenges threatening livelihoods, restricting movement of people and goods, disrupting supply chains, increasing unemployment, eroding demand, production capacities, and withering liquidity, thereby impacting the economy. Achieving sustainable and efficient agriculture supply chain will require comprehensive and integrated approach at country and state level in long run.

Government, industry, and farmers will have to work in tandem for upcoming agriculture cycles. Precision farming and plasticulture interventions over years have proven to be a boon for farmers across the globe and India too wherein the adopters have been benefitted in many folds and with the relentless support of the centre government amalgamated with states.

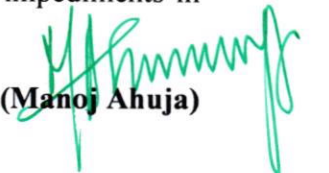
It is noteworthy, to highlight that the efforts of 22 Precision Farming Development Centres (PFDCs) established at various SAUs, ICAR Institute & IIT-Kharagpur monitored by NCPAH. These centres have developed and disseminated practices over years through technology refinement suited to local climatic conditions and providing necessary support to growers by conducting customised trainings at the grassroots has made a significant footprint in Indian agriculture and livelihoods of the growers across the country.

I am happy to note the efforts made by team NCPAH under the guidance of Dr. S K Malhotra (Ex.MS, NCPAH) further led by Dr. Prabhat Kumar (Horticulture Commissioner & MS, NCPAH) in bringing out this very report, which highlights various facets of the pandemic and how precision agriculture and plasticulture applications have supported the growers during pandemic.

The insights captured from various plasticulture industry and measures adopted by them to mitigate the impact is noteworthy. The suggestions tabled will definitely add value for upcoming policy decisions and improvement in schemes related to the sector.

I hereby convey my best wishes to team NCPAH and applaud the efforts in bringing out this very document during this unprecedented witness made by Indian agriculture, which will help in developing policies that are more robust to catalyse the impact of any such impediments in growth of Indian agriculture sector.

29<sup>th</sup> Day of August, 2022

  
(Manoj Ahuja)

डॉ. प्रभात कुमार  
Dr. Prabhat Kumar  
बागवानी आयुक्त  
Horticulture Commissioner  
Member Secretary (NCPAH)



सत्यमेव जयते

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



## MESSAGE

Agriculture in India has passed through critical phases in the past few decades and has achieved self-sufficiency in food production. Despite the fact that the country supports more than 16% world population with 2.4% land resources and 4% water resources. The achievements in the agriculture sector is laudable. Nearly 65% people directly or indirectly depend on agriculture and provide over 58% employment in the country. It contributes nearly 16% of India's GDP and consumes 80% available water resource. The COVID-19 pandemic has exposed the economy to immense distress, ruptured multiple systems and left the economy out of breath in all the sectors including agriculture as well plasticulture industry. Currently, the COVID-19 pandemic impacted the country's gross domestic product (GDP) which is contracted by 7.9% in FY21, although GDP grew at an average rate of 7% per annum in the last 20 years despite some major events.

Government of India rolled out multiple stimulus packages to revive the economy followed by the world's largest vaccination campaign. The Atmanirbhar package – an impeccable efforts of Ministry of Agriculture & Farmers Welfare, Govt. of India in bringing policies have not only benefitted the growers of our country but have also supported them to meet the food demand and rolled out many path breaking reforms particularly in the agriculture and rural sector.

Precision agriculture play an important role to maximize input use efficiency by applying right amount of inputs at right time, right place in right manner. 22 Precision Farming Development Centre (PFDCs) set-up by Ministry of Agriculture & Farmers Welfare, Govt. of India in various agro-climatic zones of the country in selected SAUs, CAUs, ICAR Institutes and IIT Kharagpur to do R&D activities and developed regionally differentiated technologies & farmer's friendly protocols to get maximum yield & revenue. Today's these centres are acknowledged as technological hub on precision agriculture practices in their respective states. The 22 PFDCs, centrally monitored by National Committee on Precision Agriculture & Horticulture (NCPAH) formerly known as National Committee on Plasticulture Applications in Horticulture constituted by Ministry of Agriculture & Farmers Welfare as National Level Agency under the Gol flagship scheme of Mission for Integrated Development of Horticulture (MIDH).

I acknowledge the efforts made by team NCPAH and 22 PFDCs in bringing out Impact assessment report entitled "Impact Assessment of Indian Precision Agriculture & Plasticulture Sector Post COVID-19" will provide valuable insight on the impact of the pandemic on agriculture & way forward will guide stakeholders to initiate necessary policy initiatives and interventions for the up-liftment of the distressed sections of the society.

  
(Prabhat Kumar)



## Acknowledgement

The pandemic has been a body blow to this country, and we are still reeling under its threat. However, it is also the time for renewal and revival. Now an evidence-based, publication like this one holds the potential to inform our policymakers to rebuild a more resilient India. COVID-19 induced lockdown has impacted Indian agriculture in many ways. While disruptions in supply chain and consumer demand affected farmer incomes, it also exposed the weakness in the existing agricultural marketing system.

The National Committee on Precision Agriculture & Horticulture (NCPAH) under the Ministry of Agriculture & Farmers Welfare, Government of India, New Delhi have been envisaged as nodal agency for monitoring precision farming and plasticulture applications under flagship schemes. An attempt is made by team NCPAH to consolidate the impact of COVID-19 on Indian precision agriculture and plasticulture sector having views from various stakeholders to consolidate this report.

I would like to acknowledge the inputs made by Dr. S K Malhotra (Ex.MS NCPAH), in taking up this very assignment and further led by Dr. Prabhat Kumar (Horticulture Commissioner, MoA & FW, GoI & MS, NCPAH), to capture various aspects that had impacted the precision farming and plasticulture sector during the pandemic and to drive suggestions that may benefit the policymakers and other stakeholders in reviewing its affect for preparing future-ready strategies to catapult such impacts.


NCPAH would also like to thank the officials of RFS, MoA & FW division for the continual support in taking this forward with their guidance and support. Sincere thanks and gratitude towards all respondents covered in the report for their time and valuable inputs contributed by way of questionnaires and interactions made by NCPAH team with each one of them during the assignment.

NCPAH acknowledges the contribution and timely response made by 22 PFDCs and their Principal Investigators in sharing the contact details of respondent farmers without which this report could not have been completed to its desired objectives. NCPAH team thanks all the famers from various parts of the country who responded very well to the questions of NCPAH and provided factual information.

NCPAH is indebted to entire precision farming and plasticulture industry for sharing the details and experiences along with suggestions, which has been the integral part of the report and for their continuous support during the preparation of the report.

I am sure the report would provide and insight on happenings that have been witnessed by the precision farming and plasticulture industry and the suggestions made would benefit the sector to meter such impediments arising due to such natural abruptions.

NCPAH thank each contribution made by all the stakeholders since conception of this report to its completion and welcome input and suggestions for such future endeavours for the betterment of precision farming and plasticulture sector in the country.

  
**Anand R Zambre**  
ED, NCPAH

## Executive Summary

Impact of the lockdowns on the Indian agriculture sector has been complex and varied across diverse segments that constitute the agricultural value chain. Several activities across the agriculture value chain have been the most hit. Acute shortage of labour, reverse migration, harvest, transportation and logistics and exports were some of the unforeseen challenges that the stakeholders across the value chain witnessed. Despite relaxations, waivers and financial support given by the government at each phase of the lockdown, the agricultural community has faced several challenges.

According to a livelihood survey, nearly 80-90% of the farmers were unable to harvest/sell produce or have sold it at reduced prices. The unemployment rate soared close to 27% with uncertainty translated into a loss in confidence amongst outstation labourers, who are the primary farm workers. Besides this, the seed industry and agri-commodity was badly affected by the lockdowns imposed during the pandemic. Further, the agro-chemical industry has also witnessed constraints on availability of raw material supplies as many of them are import dependent which has stunted the sectors business during covid. The onset of lockdowns not only have influenced the agri-industry but also the flagship programmes of centre. As the micro irrigation sector is dependent on the *Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) - Per Drop More Crop* component of the scheme witnessed 50% lower adoption due to delayed action plan for the year, which had affected the installations of micro irrigation equipment's during the kharif season. Unseasonal rainfall and hailstorm in northern parts of India, combined with the lockdown, have adversely affected the yield and delayed (for most crops other than wheat) the yield estimation for agri- insurance companies. This has resulted in an increase in agri-claims and delay in payouts.

In-order to capitulate the impact on Indian precision farming & plasticulture sector an interactive assessment is undertaken by the National Committee on Precision Agriculture & Horticulture (NCPAH) with following objectives:

### **Objectives:**

1. To capitulate information on various precision agriculture/plasticulture applications by way of questionnaire from leading sector players'/research institutions/progressive growers in India.
2. Area covered under various precision agriculture/Plasticulture applications by the respondent's/ industry stakeholders during COVID-19 period.
3. Experiences from progressive grower's w.r.t supply of products/services during COVID-19 on various plasticulture products.
4. How adoption of precision agriculture practices/plasticulture applications have benefitted during COVID-19.

5. Recommendations drawn from information received through customized questionnaires on Gap areas and way forward.

### **Methodology Adopted**

The questionnaires developed have secondary information of the respondents/stakeholders over a telephonic interaction with 10-15 minutes of discussion with each stakeholder. The questionnaires were prepared to assess real-time impact, the lockdown imposed due to pandemic and how it has influenced the overall activities of agriculture/ horticulture and socio economic conditions of the farmers, industry that represents the Indian precision agriculture & plasticulture sector across PAN INDIA. Progressive farmers covering 21 States viz. Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal were contacted. Progressive farmers selected through the Precision Farming Development Centers (PFDCs). Besides this, plasticulture Industry and State Implementing Agencies were approached. Apart from these leading plasticulture, industry players and other related stakeholders were contacted individually to have details as per the questionnaires prepared for each sector/stakeholder to establish impact witnessed due to COVID-19 along with measures adopted by them to mitigate the challenges faced during COVID period.

The assessment made is based upon the responses received from 150 progressive farmers, processors / manufacturers of plasticulture products & digital agri-system suppliers etc. Based upon telephonic discussions with various stakeholders such as farmers, government officials, members of SHGs, Farmer Clubs, Farmer Producer Organizations, the information was compiled, analysed for impact assessment of COVID-19 on precision agriculture & plasticulture applications is represented.

### **Findings:**

More than 150 progressive growers those who have adopted plasticulture applications like Micro Irrigation, greenhouses, mulching, farm ponds etc., were contacted by NCPAH officials to understand how they have managed their farm operations and what were the various impediments/bottlenecks faced during the pandemic period. The respondent farmers mentioned that lack of transport facilities, poor availability of inputs such as fertilizer and technical support along with availability of agri-labours were the major impediments faced during covid restrictions. Besides this, the precision agriculture & plasticulture component suppliers made a mention of delay of processing of action plans, restricted movement and raw material price fluctuations coupled with lack of installations have severely influenced their business volumes. The expressions made by the respondent industry players are captured in this report.



## CHAPTER -1: Introduction

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### 1.1 Introduction

India having the second largest arable land in the world with a coastline of 7500 km is the largest agrarian economy, which engages more than 58% of its population and 44% of its workforce in agriculture & allied sectors. The sector contributes approximately 17.2% to India's GDP and witnessed a steady CAGR of 2.1% between 2014 and 2018.



Ironically, the onset of the pandemic coincided with the Rabi harvest and Kharif crop-sowing season affected 140 million farmer households across the country. The lockdown delayed harvest of the Rabi crop due to non-availability of labours, machinery (harvesters, threshers, tractors, etc.) and transport, as well as restrictions on movement. Despite favourable winter conditions and above normal output, the sudden disruption in supply chain resulted in losses because of damaged crop and low profitability.

The World Health Organization (WHO) declared COVID-19 as a pandemic in January 2020; the virus has now spread to more than 190 countries. According to the International Monetary Fund (IMF), the global economy is expected to shrink by over 3% in 2020. The unprecedented rise in infections led to a nationwide lockdown, which has affected the country both economically and socially. The coronavirus pandemic has affected businesses with varying degree of intensity across different geographies, commodities and stages of the value chain across the globe. Major among these are: liquidity crunch in rural areas, non-availability of labours and transportation issues which further aggravates the problem.

The arrival of the pandemic was so swift that countries have generally not put measures in place that would flout the agreed rules of international trade. In their attempts to restrict the international movement of people who might be carrying the virus, they have inadvertently increased friction, cessation of air travel, particularly for planes used simultaneously for passengers and freight. This has disrupted supply chains for some high-end products, such as cut flowers and seafood. Panic buying has produced short run spikes in demand products.

The lockdowns imposed further led to:

- Disruptions in the procurement of food grains by government agencies.
- Disruptions in the collection of harvests from the farms by private traders.
- Shortage of workers to harvest the Rabi crop.



- Shortage of drivers to transport produce.
- Blockades in the movement of agricultural commodities across highways.
- Closure or limited operations of APMC mandis.
- Shutdowns of retail agricultural markets

## 1.2 Global Scenario due to COVID-19

United Nations has set seventeen development strategies aimed at improving the life quality of people living in different parts of the world, commonly referred to as Sustainable Development Goals (SDGs), to be achieved by 2030. SDGs comprise basic agendas that will lead to the development of various aspects of life, which was initiated in 2015.



The COVID-19 poses a potential threat to retard or even undo the progress achieved towards all SDGs. The two food-security dependent goals (i.e. SDG 1- “No Poverty” and SDG 2- “Zero hunger”) will be hit hard during the lockdown period imposed by governments to contain the spread of the virus, particularly in developing countries.

The World Food Program (WFP) estimated that 265 million individuals could be affected by acute food insecurity by the end of 2020, which is an increment from 135 million individuals before the crisis (*Food Security Information Network, 2020*). Indeed, COVID-19 added fuel to the adverse effects on the vulnerable communities who are already grappling with malnutrition and other problems.

Further, countries that count heavily on food imports and developing countries that depend on primary exports like oil are also badly affected. COVID-19 has given a fillip to technology usage across sectors. Digitization is emerging as a key trend in Indian agriculture and will have high relevance in post-covid era too. Coronavirus pandemic has lot of dark sides and humankind may have many more challenges in the days to come.

### 1.3 Role of precision farming & plasticulture applications in Agriculture

Precision farming applications or what we call smart agriculture have contributed significantly to the Indian agriculture. Adoption of precision farming & plasticulture applications has helped the growers across the globe to manage inputs that ensure the optimum needs of crops and soil, besides enhanced disease free and healthy produce with better remunerative value. These applications have not only increased the farm outputs but have also addressed the areas of soil and water pollutions by using them precisely as desired by the crops.

Sustainable precision agriculture is this century's most valuable innovation in farm management by using Information and Communication Technologies (ICTs) coupled with advancement and upscaling of existing farming applications such as plasticulture applications to produce more per unit with reduced application of inputs such as water, fertilizer and crop protection measures. Adoption of these plasticulture applications has transformed Indian agriculture to manifold increasing agricultural productivity in both quantity and quality.



Plasticulture is the application of plastics in agricultural cultivation and is fast becoming the most sought-after technique to augment farm yields and farm income. They are one of the most useful indirect agricultural input, which holds a significant footprint in transforming Indian agriculture and continuing towards bringing the "Second Green Revolution". With continued support from the government, by way of providing financial assistance have made the adoption of these applications increased over years and still growing. Applications of these technologies together offer a multitude of benefits. Plasticulture applications a precision farming components such as Green house/Polyhouse, Shade-net house, Insect-net house, Soil solarization, Plastic mulching, crop covers, micro Irrigation technologies, creation of water resources, lining of water bodies etc.

### 1.4 Plasticulture Globally offers



Globally, the use of plastic products in today's agriculture is one of the key inputs for enhancing production per unit area to feed the growing population with shrinking land per capita. The versatility and variety of plastic polymers, their ease of manufacture physical properties and



affordability make them the material of choice for many applications in agriculture and allied sector. Most fishing gear is made of plastic.

Plastic greenhouse and mulching films together with drip irrigation help fruit and vegetable growers to increase yields, reduce water and herbicide use, and control crop quality. Polymer coated controlled release fertilizer provide plants with the nutrients at the rate they need, avoiding emissions to water and air. Silage films help livestock farmers produce healthy, long lasting and nutritious fodder, and avoid the need to construct barns and silage clamps. Plastic tree guards are used extensively in tree plantations. All these plastic products provide a range of benefits that help farmers, foresters, and fishers to maintain livelihoods, enhance production, reduce losses, conserve water and reduce chemical inputs

However, despite the many benefits listed above, agricultural plastics also pose a serious risk of pollution and harm to human and ecosystem health when they are damaged, degraded or discarded in the environment.

In 2019, agricultural value chains used 12.5 million tonnes of plastic products in plant and animal production and 37.3 million tonnes in food packaging. Furthermore, the agricultural plastic industry forecasts the global demand for greenhouse, mulching and silage films to increase by 50 percent from 6.1 million tonnes in 2018 to 9.5 million tonnes in 2030. The crop production and livestock sectors are the largest users, accounting for so million tonnes per year collectively, followed by fisheries and aquaculture with 2.1 million tonnes, and forestry with 0.2 million tonnes.

Despite limitations in regional usage data, Asia was estimated to be the largest user of plastics in agricultural production accounting for up to six million tonnes annually almost half of global usage.

Polymer coated controlled release fertilizer provide plants with the nutrients at the rate they need, avoiding emissions to water and air. Silage films help livestock farmers produce healthy, long- lasting and nutritious fodder, and avoid the need to construct barns and silage clamps. Plastic tree guards are used extensively in tree plantations.

The National Committee on Precision Agriculture & Horticulture (NCPAH) being the nodal agency under the Ministry of Agriculture & Farmers Welfare, Government of India have attempted this report by way of telephonic interactions with progressive growers, industry leaders, system suppliers, farmer producer organizations and other related stakeholders.

An assessment titled as “Impact assessment of COVID-19 on Indian Precision Farming & Plasticulture sector” which is consolidated in this report collating all

details received through customized sectoral questionnaires for various stakeholders developed by team NCPAH with defined objectives.

### **1.5 Objectives of the Study**

The objective of the study was conceptualised to assess the impact COVID-19 pandemic on production and productivity of agriculture/ Horticulture crops while using Precision Farming Techniques/ Plasticulture Applications in farming operations and how this technology benefited the socio economic conditions of farmers and plasticulture Industry.

The objectives of the study to assess the impact of COVID-19 pandemic are listed below:

1. To capitulate information on various precision agriculture/plasticulture applications by way of questionnaire from leading sector players'/research institutions/progressive growers in India.
2. Area covered under various precision agriculture/Plasticulture applications by the respondent's/ industry stakeholders during COVID-19 period.
3. Experiences from progressive grower's w.r.t supply of products/services during COVID-19 on various plasticulture products.
4. How adoption of precision agriculture practices/plasticulture applications have benefitted during COVID-19.
5. Recommendations drawn from information received through customized questionnaires on Gap areas and way forward.



## CHAPTER - 2: Methodology

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To assess the impact of COVID-19 with reference to pre-covid year 2018-19 and that of during the years 2019-20 & 2020-21 on production & productivity of agriculture/ horticulture stakeholders adopted precision farming technologies and plasticulture applications were identified through PFDCs. In order to capture details desired for the assessment-customised questionnaire for progressive farmers as well as for plasticulture industry was developed.

The questionnaires were developed to have secondary information's of the stakeholders over a telephonic interaction with 10-15 minutes of discussion with each stakeholder. The questionnaires were prepared to assess real-time impact, the lockdown imposed due to pandemic and how it has influenced the overall activities of agriculture/ horticulture and socio economic conditions of the farmers, industry that represents the Indian precision agriculture & plasticulture sector across PAN INDIA.

To collect the data on progressive farmers, the Precision Farming Development Centers (PFDCs), plasticulture Industry and State Implementing Agencies were approached to have contact details for contacting each respondent. Progressive farmers covering 21 States viz. Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal were contacted by NCPAH officials.

The assessment is made based upon the responses received from over 150 progressive farmers, Industry processing / manufacturing plasticulture products & digital agri-system suppliers etc., the information was compiled, analysed for impact assessment of COVID-19 on precision agriculture & plasticulture applications is represented in this report.

Various impediments witnessed w.r.t. production, productivity, supply of precision farming products/services during COVID-19, availability of inputs and outputs, Labour availability for farming operations, marketing of agricultural produce, transportations constraints, industry prospects, processing of plasticulture products



at Industry, constraints faced, Govt. support etc. have been highlighted with each stakeholder.

### **Limitations of the Study**

- Selection of respondent farmers per state 5-10 only based upon the contact provided by PFDCs.
- The content developed mostly on secondary information and experiences witnessed during pandemic period 2019-20 & 2020-21.
- Network issues at respondent's end and inability to respond the query as desired.
- Resilience to share actual sales/data of the period in reference by industry.



## CHAPTER - 3: Impact of COVID on the sector- Farmers & Industry

### 3.1 Farmers Prospect

During the assessment, it was noted that some farmers have adopted single plasticulture technologies and more of them are using in combination of two or more plasticulture applications with drip irrigation that helped flowers, fruit and vegetable growers to increase yields, reduce water and herbicide use, and control crop quality.

According to feedback of the respondent farmers of the selected study states, the respondent farmers have witnessed enormous benefits in production & productivity of crops. Besides this, farmers applauded the efforts and financial assistance provided by various Gol flagship schemes having precision farming and plasticulture components.

#### 3.1.1 Globally India Position on productivity of Crops

As regards, India's is the largest producer of pulses, okra, mango, banana and lemon and the second largest producer of wheat, rice groundnut, potato, tomato, onion, cabbage, cauliflower, brinjal etc.) in the world and India produces more than one fifth of global production of paddy and pulses. However, the productivity per unit area most of the crops is low worldwide.

Whereas, Horticulture crops viz. okra, cauliflower, brinjal, banana, mango and papaya where Indian precision farming is widely adopted contributes to more than twenty per cent of global production of many of the horticulture crops but low level of productivity per unit area is the concern. The precision farming such as Micro irrigation system, protected cultivation has enhanced yield of crops up to the extent and still adoption level among farmers is low.

Table -1: Worldwide India's positions and rank in crop production

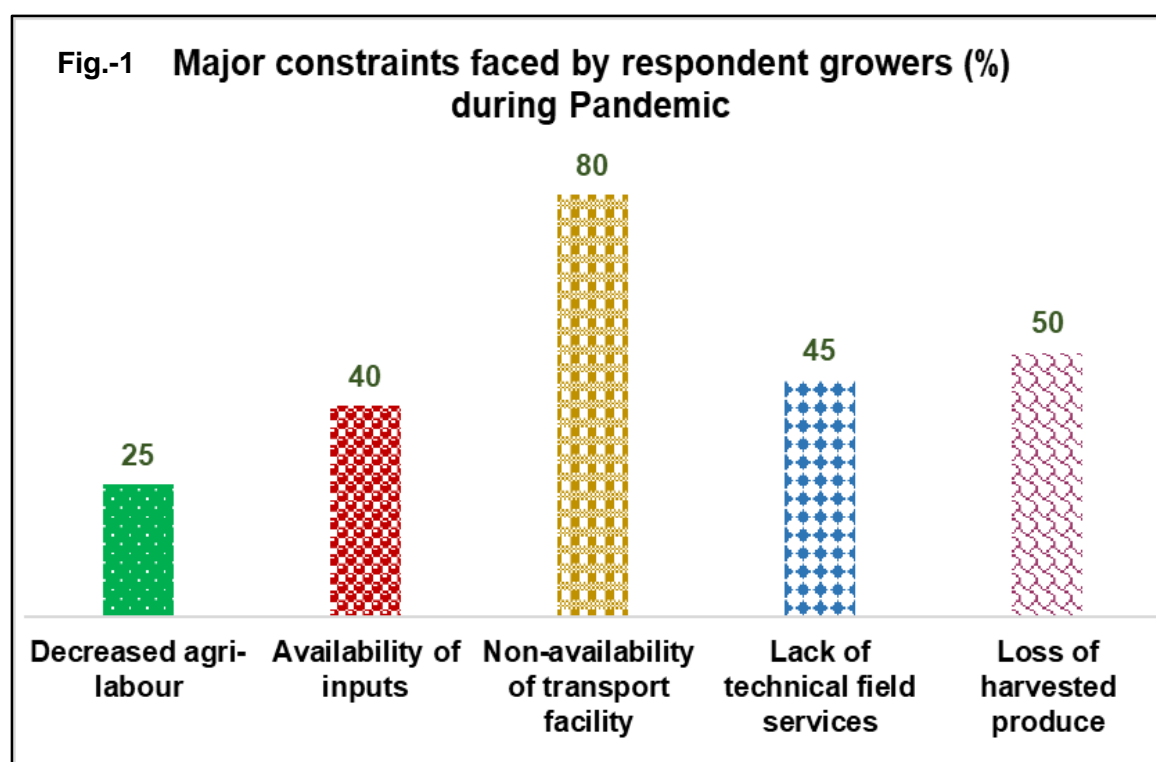
Crop	India (Million Ton)	World (Million Ton)	India's		Next to
			Share (%)	Rank	
Fruits & Vegetables					
Vegetables & melons	120	1075	11.2	2nd	China
Broccoli & Cauliflower	8.2	25.2	32.5	2nd	China
Brinjal	12.6	51.3	24.5	2nd	China
Banana	29.1	113.2	25.7	1st	
Fruits excluding melon	91	866	10.5	2nd	China
Mango & Guava	18.8	46.5	40.4	1st	
Lemon & Lime	3	17.3	17.2	1st	
Papaya	5.6	12.6	44.4	1st	

Potato	44	377	11.6	2nd	
Onion (dry)	19.4	93.2	21	2nd	China
Tomato	18.4	177	10.4	2nd	
Okra	5.5	9	62	1st	
Cabbage & other Brassicas	9	71.2	11.2	2nd	China
Total Cereals	294	2849	10.3	3rd	China, USA
Wheat	93.5	749.5	12.5	2nd	China
Rice (Paddy)	159	741	21.4	2nd	China
Total Pulses	17.6	82	21.5	1st	
Groundnut (in shell)	7	44	15.6	2nd	China
Rapeseed	6.8	69	10	3rd	Canada, China

Source: FAOSTAT

### 3.1.2 Impact on plasticulture applications on Production & Productivity

During COVID-19, pandemic period productivity has gone down up to the extent up to 15% due to sudden lockdown, timely availability of agricultural inputs and also agri-labours have hindered agri-operations due to migration imposed due to pandemic. The major constraints faced during the pandemic is given below based upon the details received from the growers.





Although farmers have obtained good yield & quality as compared to traditional method of cultivation, but we could not get the desired income due to lack of transport facility, lockdowns and proper market even no buyers of the produce.

The selected growers responded that how precision farming & plasticulture technologies benefited the production, productivity & farm-income, the benefits witnessed given by farmers and continued adoption of these technologies will certainly boost the uptake of these technologies in the country to next level of adoption among the farmers. The experiences shared were quite notable and few of them are listed here for the benefit of all stakeholders:

On plastic mulching most of the farmers shared that while using plastic mulch in crops we have reduced requirement of manual labours for weeding by 90-95%, irrigation interval has also increased, and thereby less of irrigation is required in a crop cycle as compared to traditional method of cultivation.

Increased yield of crops by 20-30% with better quality and cleaner crop is also obtained. In some instance, they also mentioned that there is doubling of yield in case of tomato crop as compared to non-mulch practice. Most of the farmers having opined that the availability of quality mulch material is a constraints and it is the cost is increasing hence cost benefits become marginal.

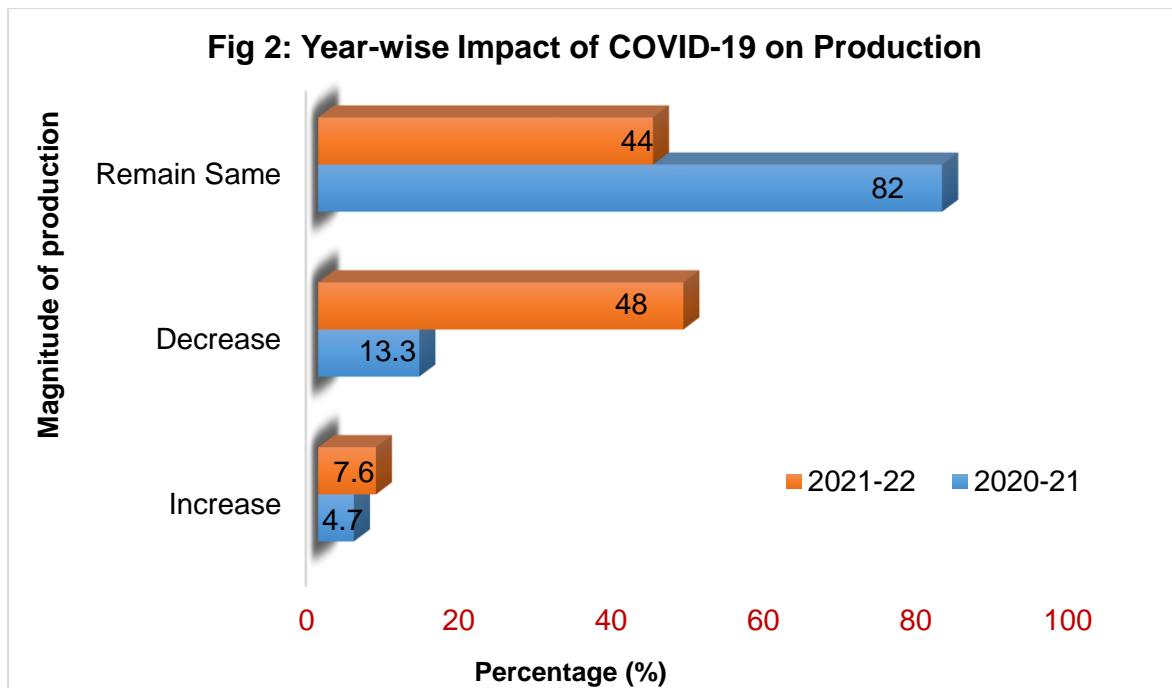
**Production of crops:** Farmers revealed that the production cost was high during COVID-19 pandemic due to lack of timely inputs, higher cost of inputs even labours for farm operations, black marketing of inputs (seed, fertilizer & chemicals). Farmers also highlighted the erratic rainfall also impacted field management.

Overall production of crops per unit area slightly decreased around 10-15% but production cost increases by 20-25% as compared to pre COVID-19 Pandemic. Farmers revealed that lock-down restrictions and the crisis of COVID-19 heterogeneously affect the income, food security, and agricultural activities of small farmers in India.

### **3.1.3 Overall Impact of COVID-19 on Production of Crops**

According to the respondent farmers (82%) perceived that magnitude of agricultural production remain same, only 13.3% farmers told that production level has gone down up to 15% during COVID-19 pandemic during 2020-21.

44 % respondent farmers mentioned that the production level remain same in 2021-22 as compared to 2019-20 while using precision farming & plasticulture applications where COVID-19 affected the agriculture production (Fig.2).

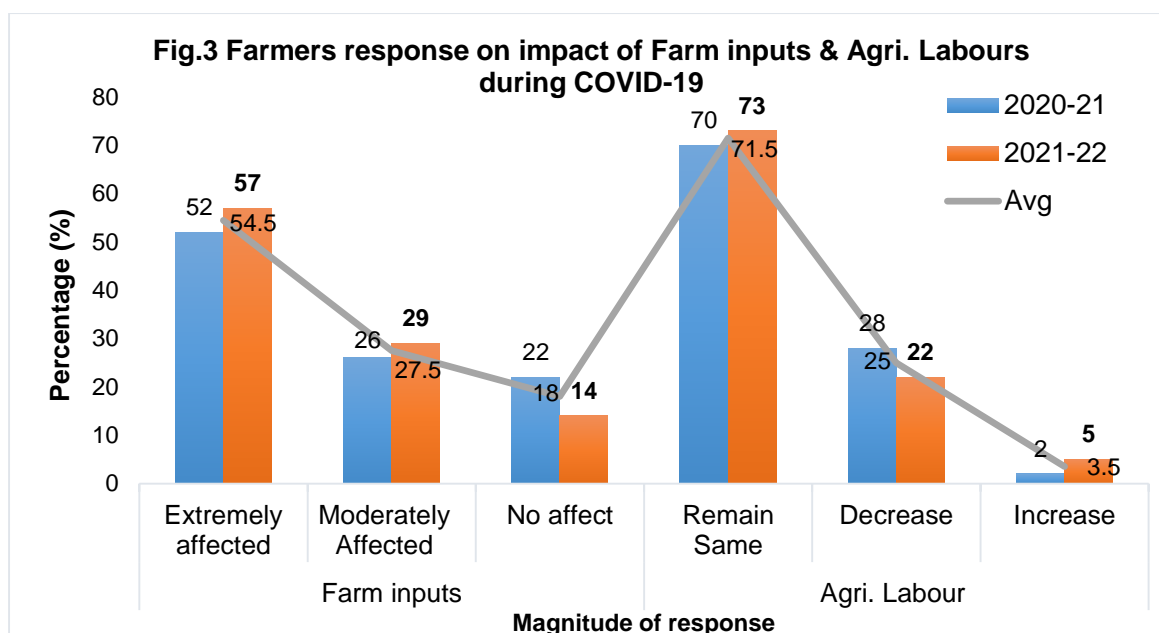


Whereas in 2021-22, approximately half of the respondents (48%) mentioned that the production level decreased as compared to 2019-20 due to severe constraint's as mentioned earlier (Fig.1). Besides this, few respondent farmers 4.7% & 7.6% respectively in 2020-21 & 2021-22 farmers mentioned that there is incremental production during COVID-19 pandemic.

### 3.1.4 COVID-19 Impact of Farm inputs & Agri. Labours

The magnitude of responses received from the respondent farmers of COVID-19 impact on agri-inputs & labours using precision farming techniques and uses plasticulture applications. (54.5%) respondent growers stated that they were extremely facing disruptions in receiving and purchasing fertilizer and seed from market during COVID-19 viz. the delivery and purchase of fertilizer by 70%, seed by 85% and pesticides by 82%. Over 27.5% of respondent's farmers stated that they were facing moderate effects in the supply of the different farm inputs during COVID-19 pandemic. However, only 18% revealed that no effect on farm inputs were faced as they managed by available stocks of farm inputs and support of family labours.

Some of the respondents revealed that pandemic posted restrictions of labours for harvesting of field crops such as wheat due to which most of the crops remain in the field and produce was lost in absence of labours for harvesting. Although, 71.5% (Fig.3) of the respondent farmers revealed that agricultural labours availability was not an issue but they are scared of being infected by close contact with labours and not maintain social distancing.



Some of respondents mentioned that they have managed their involving family labours. Among all the respondent farmers 25% reported that there was, shortage of labours to manage farm activities and around 3.5% respondent farmers revealed that there were surplus labours due to migration and back to home.

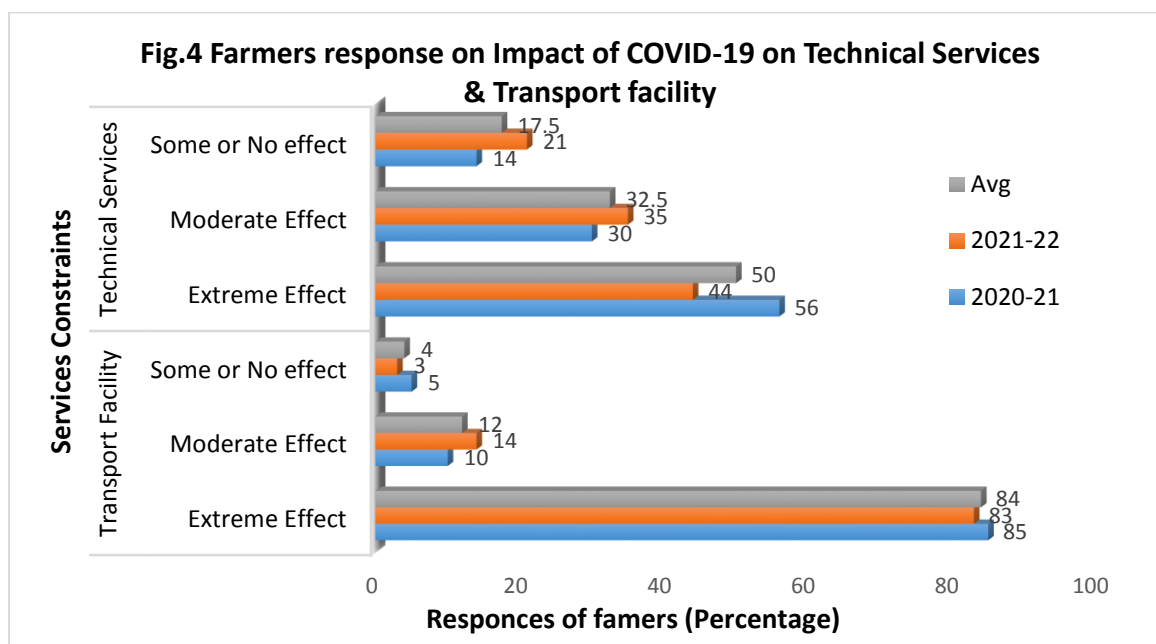
### 3.1.5 Impact of COVID-19 on Technical Services & Transport facility

50% of respondent farmers mentioned that pandemic had severely affected technical services required for operations and maintenance precision farming tools /technical gadgets / infrastructure lying in the field, resulting loss of agricultural inputs with crop loss. 32.5% of respondent farmers mentioned moderate effect, however, 17.5% farmers were slightly effected or no effect on crop production. Most of them mentioned that the accessories required for maintenance was not available and company were not able to provide the services as well as spare parts due to restricted movements and transport facilities.

These COVID-19 pandemic affected agricultural and food systems in very diverse ways. Although, the central government restricted commercial and industrial activity and imposed a ban on movement of people and goods deemed 'non-essential' from 25<sup>th</sup> March, 2020, whereas, an addendum was issued two days later allowing exceptions for agricultural activities, marketing of agricultural goods, custom hiring and inter-state movement of agricultural equipment and manufacturing activities of agricultural inputs. Thereby reducing the extent of adverse impact on farmers to take the harvested produce to APMCs/Mandis through roads.

Most of the farmers revealed that we indeed did not spend more on wages, but on transport, food, and accommodation arrangements for their labourers during the lockdown. In addition, whereas farmers were exposed to agricultural income losses

due to an increased cost of labours and limited opportunities to market their crops during the lockdown due to transport facility.



On impact of transport facility for agricultural supply chain during COVID-19 pandemic the 84% (Fig. 4) respondent farmers revealed that farmers are extremely effected and couldn't market the produce on time and unavailability of buyers too. Among the respondent farmers 12% stated that they have moderately effected and unable to avail transportation for transporting fresh food to urban and local markets and only 4% mentioned there was no effect of transport facility.

### 3.1.6 Impact on supply chain

Flowers, Fruits and Vegetable crops substantially influenced due to prolonged lockdown and restriction in movement across the country, moving agricultural produce from one place to another was a challenge. These horticulture produce being perishable in nature began to rot while consumers to pay sky-high prices in retail markets.

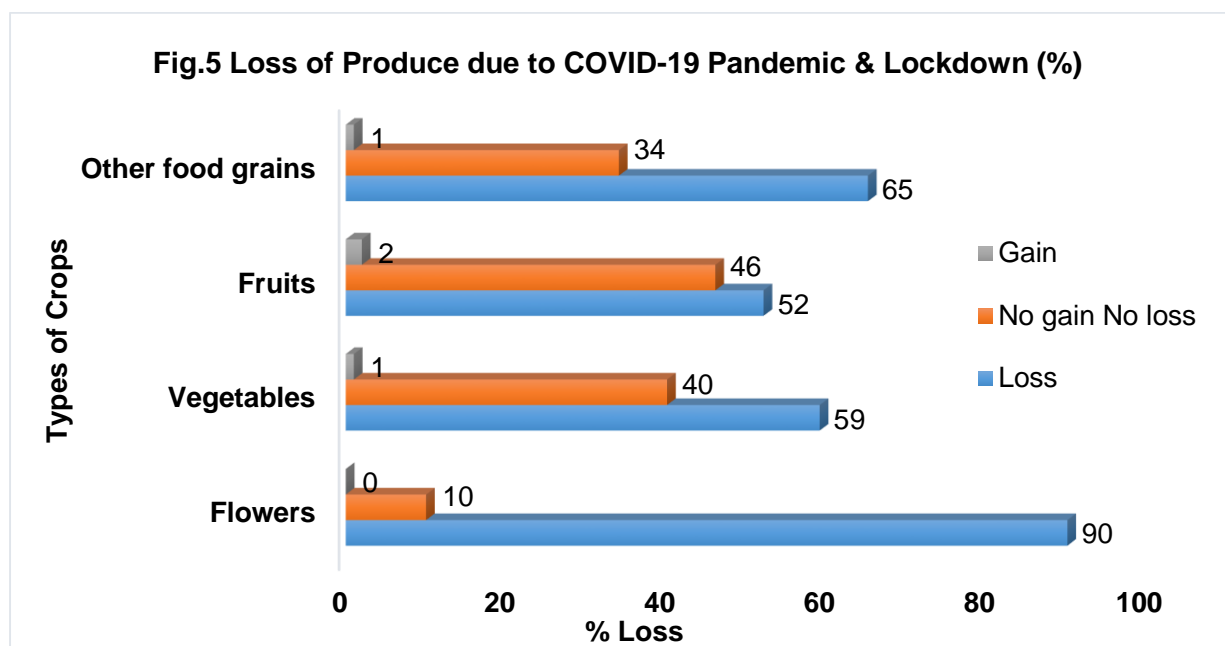
However, this disruption also underlined the necessity of robust, secure crop/fresh produce storage facilities for the long run. Govt. has to pay more attention to investment more in the food-processing sector, which is a prolonged demand from farmers.

### 3.1.7 Loss of Produce due to COVID-19 Pandemic & Lockdown

Horticulture production such as flowers, fruits and vegetable crops substantially influenced due to prolonged lockdown & restriction in movement across the country, moving agricultural produce from one place to another was the great challenge. These horticulture produce being perishable in nature began to rot while consumers



to pay sky-high prices in retail markets. The investment to undertake flower gardens in open cultivation is between somewhere between 50,000 and 1 lakh per acre and those who put up flowers in about 1,200 poly houses, invest in orchids, carnations and roses anywhere between 3 lakhs and 4 lakhs.



Due to highly perishable nature of the product (every day the value reduces by more or less 15%) requires quick sales or a cold chain for distant markets. The closure of air and surface transport has to bring the horticulture industry to a halt. This shift in supply led to a closure of the local mandis, neighborhood shops and deliveries, whether through street vendors or online platforms in urban areas.

However, COVID-19 pandemic ruin the produce badly and the respondent farmers revealed that horticultural produce has been badly affected by COVID-19 Pandemic. States loses produce by 90% of flowers, 59% of vegetables, 52% of fruits and 65% other food grains (Fig.5), whereas sizable farmers of these sector such as flowers (10%), vegetables (40%), fruits (46%) and other food grains (34%) stated there is no loss no profit received in produce & marketing.

The responses of 150 respondent farmers over crop yield mostly horticultural crops is tabulated in the Table 2. The impact of COVID-19 pandemic severally affected yield of crops compared with year 2019-20 (Pre COVID-19 period) and productivity has gone down up to some extent up to 15% due to sudden lockdown.

Non-availability of agricultural inputs on time and migration of labours as well as fear & social distancing, non-availability of transport, lack of technical services and loss of harvested produce. Although farmers had obtained good yield & quality over traditional method of cultivation.

**Table-2: State-wise farmer's views on production during COVID-19**

State	No of farmers	Farmers views on Production during COVID-19					
		2020-21 (vs. 2019-20)			2021-22 (vs. 2020-21)		
		Increase	Decrease	Remain same	Increase	Decrease	Remain same
Assam	7	0	1	6	4	0	3
Bihar	7	0	1	6	3	1	3
Chhattisgarh	8	0	1	7	3	1	4
Gujarat	7	1	1	5	4	0	3
Haryana	4	1	0	3	2	0	2
HP	7	0	1	6	3	0	4
J &K	5	1	1	3	2	1	2
Jharkhand	8	0	1	7	4	1	3
Karnataka	5	1	1	3	2	1	2
Kerala	8	0	2	6	4	0	4
Maharashtra	6	0	1	5	2	1	3
Manipur	5	0	1	4	2	1	2
MP	9	1	1	7	4	1	4
Odisha	11	0	1	10	6	0	5
Punjab	8	1	1	6	4	1	3
Rajasthan	6	0	1	5	3	0	3
Tamil Nadu	8	0	1	7	4	1	3
Telangana	8	1	1	6	4	0	4
UP	7	0	1	6	4	1	2
Uttarakhand	8	0	0	8	5	0	3
West Bengal	8	0	1	7	3	1	4
Total	150	7	20	123	72	12	66
Avg.(%)		4.7	13.3	82.0	48.0	8.0	44.0

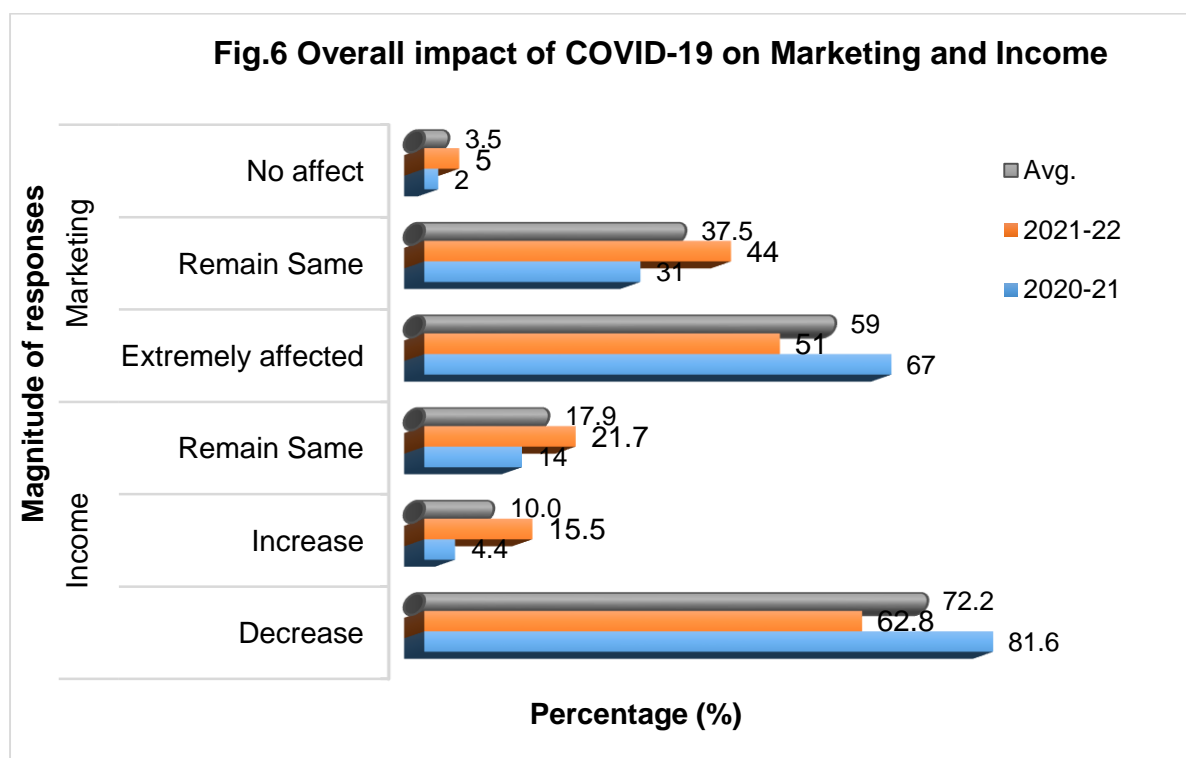
The table indicates that in first phase of pandemic, 13.3 % of respondents revealed yield reduction of crops, 4.7% farmers noticed increase in yield and 82% farmers revealed that there is no reduction in yield of crops while using Indian precision farming techniques. Similarly, in second wave of pandemic 48 % farmers revealed increase in yield as compared to first phase of pandemic, 12% farmers revealed decrease in yield and 44% respondent revealed yield remained the same as compared to first pandemic.

### 3.1.8 Overall impact of COVID-19 on Marketing and Income

Due to disruption in marketing of agricultural produce in mandis and rural haats, and reduced farm gate prices, the income of farmers declined leading to poor recovery. The marketing of the harvested produce been impacted adversely due to limitations of road transportation in many regions of India.

Magnitude of response received from the respondent farmers highlighted that 59% of farmers reported extremely affected by COVID-19 pandemic and mentioned that we could not avail transportation, fresh food to urban and local markets due to pandemic.

However, 37.5% of respondent's farmers being able to have regular access to markets during COVID-19 (Fig.6) while only 3.5% of the respondent farmers reported that they have no impact of marketing during lockdown. Their main restrictions to markets access were transport limits as well as adult members in the house being self-quarantined.



### 3.1.9 Impact of COVID-19 on income of farmers

Rise in the cost of cultivation, scarcity of farm labours, increased cost of labours and limited opportunities to market their crops, lack of transport facility & limited assess of markets during the lockdown etc. all have contributed to the loss of profit during the pandemic period. The COVID-19 caused food market closure and domestic and international travel restrictions. Only two options left for farmers. Firstly, either they sold their produce to nearby markets, or they were unable to sell produce at all

resulting farmers received a lesser price secondly, whenever the markets were completely closed and farmers did not have anywhere to sell their produce, they were forced to dump horticultural produces to compost them or to give them away to neighbor's and others.

Most of the respondent farmers (72.2%) revealed that their economic conditions changed during these days whereas 17.9% respondent farmers said that economic conditions had not changed although during pandemic 10% of respondent farmers said that their income has increased by using precision farming technologies and plasticulture applications. However, this disruption also underlined the necessity of robust, secure crop/fresh produce storage facilities for the long run.

Govt. has to pay more attention to investment more in the food-processing sector, which is a prolonged demand from farmers.

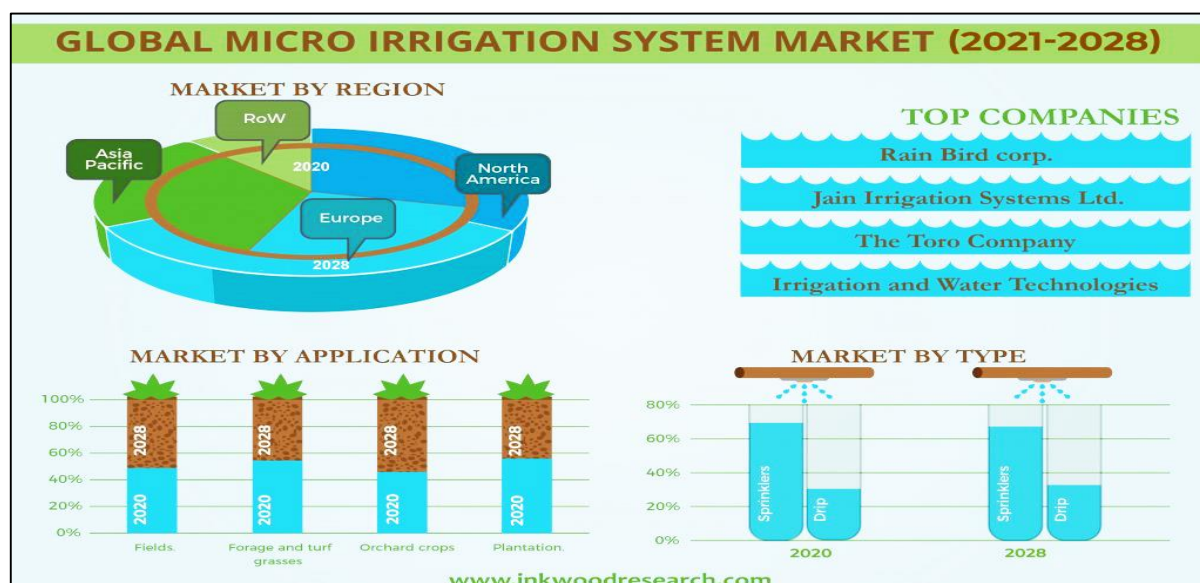
### 3.1.10 Availability of skilled labours

The lockdown imposed during 1<sup>st</sup> phase have forced restrictions of available skilled labours/ farm workforce engaged in farm operations and agri-supply chain across the country. Many respondents reported that initially the farm operations were struck adversely due to un-availability, however this very crisis have made them to apply digital inputs such as automation of irrigation systems etc., have proved to be boon during the pandemic.

Besides this, few growers have installed automated sorting & grading equipment's on-farm for segregation of harvested produce for delivery to retail outlets/mandis.

### 3.2 Micro Irrigation Sector

The global micro-irrigation systems market is projected to register a CAGR of 10.9% during the forecast period (2016-2026). Despite qualifying as essential services





during lockdowns in many countries, irrigation companies faced a difficult time in securing equipment, inputs, and maintenance. They also faced significant fiscal stress due to additional costs and lower revenues from state transfers and tariffs. The UN has estimated that farms will need to increase the production by 60-70% by 2050 in order to meet the demand of the gruelling population around the globe. Micro irrigation systems will have continued to gain traction due to decrease in available water resources and unsurmountable pressure on water bodies to produce more with less. Government driven centrally sponsored programs and financial incentives for the farmers under these will be a key for agriculture in times to come, besides development of micro irrigation market in the country.

As reported of the roughly 225 mha irrigated area in the world, only a little over 11 mha is micro irrigated. Much of this lies in four main countries: India, Spain, China and the United States of America. Together, these countries represent nearly two-third of the world's micro-irrigated area. These countries, especially USA, also have significant sprinkler irrigated areas and are among the top five countries with respect to the adoption of planned irrigation technologies.

The major players that contribute to the growth of the global micro irrigation system market include Deere & Co., Elgo Irrigation Ltd., Jain Irrigation Systems Ltd., Netafim Ltd., Rain Bird Corp., Reinke Manufacturing Co., Inc., Rivulis Plastro Ltd., and others. By adopting various market strategies such as product launch, merger & acquisition, partnerships collaborations, and others, these market players are gaining a strong position in the market. The growth of Micro Irrigation Industry since 2005 under Gol schemes is plotted in Fig.7.

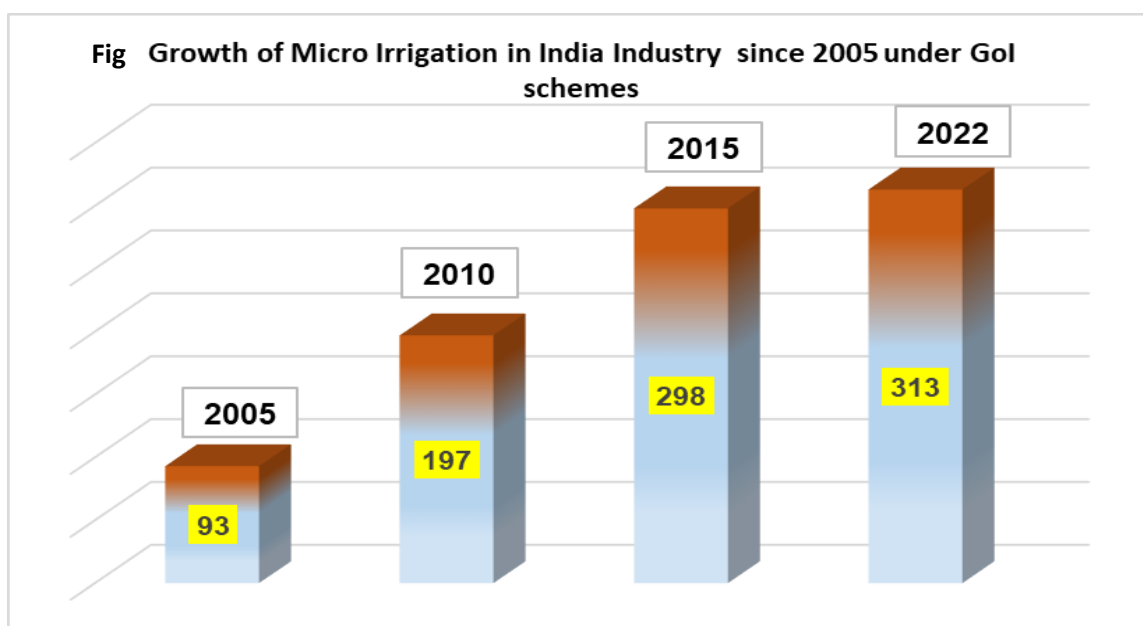
Every industry, sector, and economy has suffered from the devastating effects of COVID-19. The micro irrigation sector and digital agriculture component suppliers is no exception, as the pandemic continues to have complex and far-reaching impacts. Micro Irrigation agencies across the country have continued to function despite challenging circumstances. However, there have been multiple shocks influencing service delivery, such as fiscal constraints, interruption of supply chains due to travel restrictions, and lack of availability of labour.

Furthermore, it is noted that a lack of accessibility to irrigation equipment and other inputs was the major issue that farmers faced. Unprecedented rains, weather abruptions burdened with increasing water-stress among the growers have pushed them to adopt the water saving techniques namely drip & sprinkler to produce more with available water resources.

Increased coverage under micro irrigation can be the most effective mode of water conservation. With the objective of facilitating the States in mobilising resources for expanding coverage of micro irrigation, a Micro Irrigation Fund (MIF) with corpus of

₹5000 crores was created with National Bank for Agriculture and Rural Development (NABARD) during 2018-19, 2019-20.

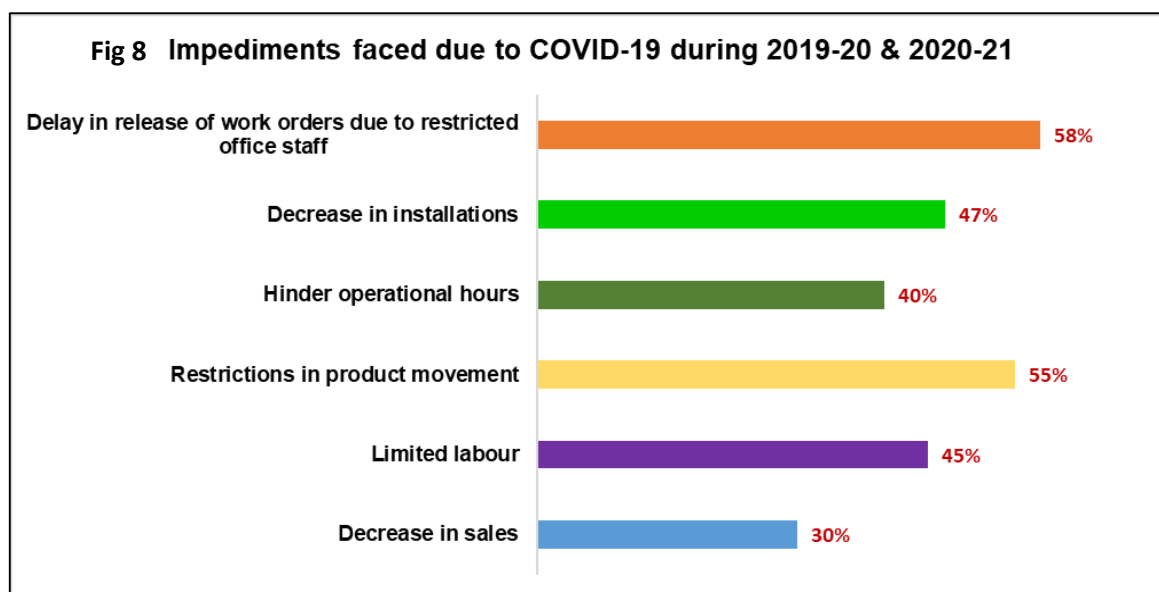
As on 01.12.2021, projects with loans under MIF amounting to ₹3970.17 crore have been approved for 12.81 lakh ha of Micro Irrigation area.



Moreover, the Government of India is promoting micro irrigation viz. Drip and Sprinkler Systems in the country for enhancing water use efficiency at farm level under the Per Drop More Crop component of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY-PDMC) from 2015-16. Presently under the scheme, more than 300 system suppliers are registered across PAN INDIA for supply of micro irrigation components. However, unprecedented emergencies posed by COVID-19, burdened by new challenges many have used the crisis as an opportunity to tackle the situations and to arrest future losses. Limited staff availability in the field has also led to the introduction of automated irrigation systems in systems and on farms with financial and technical support, small-scale farmers could take advantage of more efficient, automated and affordable irrigation systems, online extension and improved communication between annual action plan of PMKSY, there is uncertainty and the industry faced to shrink by 50% in the short term. After the relaxations offered by the government, irrigation manufacturers have commenced businesses.

However, due to liquidity crunch and transportation challenges, they were under serious pressure for timely delivery of machines and installation of micro-irrigation systems. Despite the relaxations offered by the government for the sector, most of the companies were unable to start production during the lockdown. The remaining companies were operating with limited capacity due to shortage of labour.

agencies and clients. The first quarter from April to June is the peak season for the irrigation sector. The sector is heavily dependent on PMKSY. In the absence of the



restrictions laid by Ministry of Health (MoH), GoI have poised decreased/alterd work force at government offices, which had delayed the release of work orders/approvals for subsidies and disbursements. Based upon the interactions and details captured through the questionnaires the major impediments faced by the sector is highlighted in the graphical representation.

The need to grow more with less, and the desire to better serve thriving farms, the irrigation sector was already in the process of repositioning itself towards modern and sustainable service provision, and the pandemic adds urgency to existing sector transformation needs.

This includes the need for a broader strategic approach that includes transforming governance and service provision, supporting watershed management, improving water productivity and efficiency, and an overall greening of the sector through water-smart agriculture.

### 3.3 Digital Agriculture Sector

India's digital ecosystem is witnessing healthy tailwinds such as affordability and availability of high-speed internet and maturing digital content across the sector. It is heartening to see both the central and state governments proactively launch initiatives to promote agritech ecosystem in the country.

Encouraging localized data collection on soil health and providing access to government research facilities to agritech start-ups could further help accelerate the adoption of agritech.





Agri-tech players operating in the addressable segments in India have received a cumulative investment funding of US\$532m as of April, 2020. A comparison with global investment funding patterns reveals that Precision agriculture and farm management companies are under-funded in India.

Digital technologies have been part of agriculture since well before the COVID-19 pandemic began, but the current crisis has given further impetus to finding new applications for technology in food production. The onset of the COVID-19 pandemic, digital agriculture tools have enabled smallholder farmers to continue receiving advisory, acquire much-needed financing, receive inputs for their farms and identify new markets for their products. Declining incomes and disruptions to the food supply are exacerbating extreme poverty and are challenging food security, forcing farmers to make tough choices.



Digital advisory, agricultural digital financial services (Agri DFS) and agri. e-commerce solutions have emerged as the three most sought-after digital tools by farmers during the pandemic. Rather than introducing new tools and applications, most agribusinesses and agritech companies added COVID-19 advisory to their existing digital tools. Precision farming is the most attractive end-user industry in the digital market during COVID-19 times and it ongoing. It had not only helped the growers to mitigate the hick-ups faced in farm activities but have also supplemented the need of need of growers in various aspects.

By most accounts, digital usage among smallholder farmers has increased during the pandemic. In the absence of in-person gatherings, farmers and other ecosystem players have turned to social media platforms, such as WhatsApp, Facebook Groups and even Twitter, for agronomic advice and to access markets for their crops.

### **Current Initiatives under digital agriculture in India**

- The non-profit Precision Agriculture for Development (PAD) introduced a digital advisory tool called Krishi Tarang (later rebranded as Ama Krushi) in June 2016. Ama Krushi is a digital advisory tool that provides farmers with agronomic advice on up to 24 different crops through an IVR hotline and SMS.

The service, which is free to farmers, is provided in partnership with the Department of Agriculture in the state of Odisha along with other agencies in the various states where Ama Krushi is





available. With in-person extension services suspended, Ama Krushi was able to add 40,000 to 50,000 customers per month through much of 2020 to reach the one million-customer mark in September 2020. They estimate that 5.6 million outbound messages were sent between April and June 2020 alone.

- In India, the Ministry of Agriculture introduced a new app called Kisan Rath in April 2020 in response to transportation restrictions and mandi (market) closures that affected smallholders nationwide. The Android-based app is an Uber-like app that links smallholder farmers and traders to transportation companies. Farmers upload information on the volume and destination of the crop. Truck owners can then agree to transport that volume to the appropriate destination. Despite some early glitches, the app registered over 80,000 farmers and 70,000 traders in the first week after it launched a sign of the demand for this type of service.



- Cisco developed an Agricultural Digital Infrastructure (ADI) solution in August 2019, which enhances farming and knowledge sharing. This ADI is likely to play a vital role in the data pool that will be created by the Department of Agriculture under the National Agri Stack. The pilot project was commissioned at Kaithal (Haryana) and Morena (Madhya Pradesh).

- The Jio Agri (JioKrishi) platform launched in February 2020 digitises the agricultural ecosystem along the entire value chain to empower farmers. The core function of the platform uses stand-alone application data to provide advisory; the advanced functions use data from various sources, feed the data into AI/ML algorithms and provide accurate personalised advice. The pilot project for this initiative was introduced at Jalna and Nashik (Maharashtra).



- ITC has proposed to create a personalized 'Site Specific Crop Advisory' service to turn conventional crop-level generic advice into a personalised site-specific crop advisory for farmers, using a digital crop monitoring platform, hosted on ITC's e-Choupal 4.0 digital platform. The pilot project for this initiative will take place at Sehore and Vidisha (Madhya Pradesh).
- In June 2021, The Ministry of Agriculture and Farmers Welfare signed a MoU with Microsoft to run a pilot programme for 100 villages in 6 states. Under the MoU, Microsoft will create a 'Unified Farmer Services Interface' through its cloud computing services. This is a major part of the ministry's future plan to create 'AgriStack' - a unified platform to provide end-to-end services across

the agriculture food value chain to farmers. Unique farmer IDs for farmers across the country will be created to integrate it with various government schemes and create digital agricultural ecosystems.

### **Benefits of Digital Agriculture**

Implementing these, technological solutions enable reliable management and monitoring of farms. Beside this following benefits could be achieved through digital agriculture



- Increases agriculture productivity and lowers production cost
- Inhibits soil degradation & decreases chemical application in crop production
- Promotes effective and efficient use of water resources
- Uplifts socio-economic statuses of farmers
- Reduces environmental and ecological impacts

As the Indian Agriculture and Allied sector is on the verge of adopting modern technologies, such as IoT, AI/ML and agri-drones for unmanned aerial surveying, Indian and foreign agritech players can play a vital role in supplying these advanced technologies to farmers. However, influential factors that will define the success of digital agriculture in India are technology affordability, ease of access and operations, easy maintenance of systems and supportive government policies.

### **3.4 Precision Farming & Plasticulture Industry**

The COVID-19 pandemic has exposed the economy to immense distress, ruptured multiple systems and left the economy out of breath. The present study has made an attempt to unleash the business-related issues faced by Indian precision farming and plasticulture industry due to COVID-19 pandemic. The data were collected from plasticulture manufacturers and processing industry all over the country.

As per the industry sources, India is the third largest user of plastic after America and China. Per capita plastic consumption in India is about 6 kg, which is too less compared to the world average 26kg. About 50,000 plastic processing plants and 18,000 injections moulding plant are active in India. Most of the plastics products are consumed locally and the country exports nominal chunk mainly to African and Gulf countries. The plastic processing industry is highly fragmented and consists of micro, small and medium units. There are over 35,000 registered plastic processing units of which about 75% are in the small-scale sector. The small-scale sector, however, accounts for only about 25% of polymer consumption which offers

employment to about 50 lakh workers in the country. The industry also consumes recycled plastic, which constitutes about 30% of total consumption. The domestic downstream industry comprises three broad segments: injection moulding, blow moulding and extrusion.

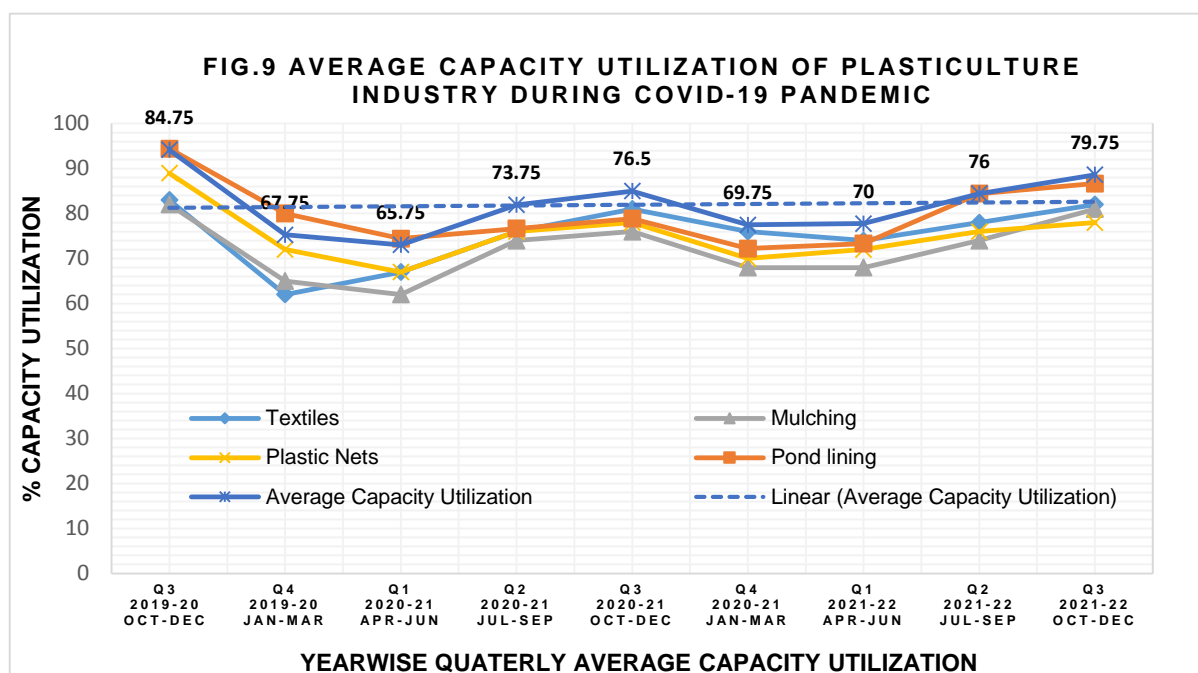
Plasticulture Industry is highly unorganized sector. Plasticulture applications most widely used in agriculture, water management, hi-tech horticulture & related applications are made of PE (LLDPE, LDPE and HDPE), PP and PVC. Major plastic products use in agriculture sector are Drip irrigation system (LLDPE, PVC, PP), Sprinkler irrigation system (HDPE, PVC), Sub-surface Drainage (PVC), Pond/canal Lining (LDPE, LLDPE, EVA), Greenhouse film (LLDPE, LDP, EVA), Insect nets (HDPE), Plastic Tunnel (LLDPE, HDPE, PPNW), Shad net (HDPE), Plant Protection Nets (HDPE), Mulching (LLDPE, PPNW), Soil Solarisation (LLDPE), Cap Covers (LDPE) etc.

Plasticulture industry is constantly upgrading range of plastics raw materials to offer cost economic and technical advantages – unheard of in earlier days – which constantly upgrades the plasticulture product scenario to work in favours of the farming community. Plasticulture applications play a significant role in precision agriculture such as micro irrigation and controlled environment agriculture for better utilization of land, water, sunlight and raising crops in extreme climatic conditions. The use of advanced irrigation techniques such as drip and sprinkler irrigation technologies have enabled raising crops on undulating terrains, saline soils, areas with brackish water besides attaining saving of water and other inputs as fertilizer, increase in productivity, improvement in quality of produce thereby the environment. The present COVID-19 pandemic has impacted the industry at certain level and causes crisis.

To ascertain the crisis caused to this sector due to COVID-19 and their impact, NCPAH had dialogued with Industry personnel over phone to assess the level of crisis caused based on the customised questionnaire. The result revealed that the plasticulture industry was affected in several ways due to the pandemic leading to low-scale operations, and eventually, a negative impact on production volumes. Over a period, this adversely affected the turnover and revenue during COVID times. Industry has faced various problems in the field of production & productivity, transportation, non-availability of skilled workers, sale of products, working capital and cash flow, reduced export/ import orders, besides restrictions. It was found that the major business-related issues faced by industry due to COVID-19 include the radical effect on the working capital of the business and on future marketing campaigns to seek new orders.

### 3.4.1 Capacity Utilization of Plasticulture Industry

COVID-19 put an immediate pause to many business activities across the globe, as several countries had shut down their ports, airports and domestic transportation while imposing nation-wide lockdowns, leading to a disturbance in business and civil



life. The lockdown in India impacted manufacturing activities across the globe. India took special measures to control the spread by imposing one of the longest lockdowns in the world, to cushion the scarce availability of healthcare resources. The enormity of the lockdown affected manufacturing activities and supply chains alike, disrupting the overall economy. Although as per the respondent views. Fig.9 clearly indicates that that Indian precision farming and plasticulture Industry (where four major sector has been taken into account are pond liner, plastic nets (mainly shade nets & Insects nets), plastic mulching and agro-textiles) have utilised average 73.8% of their capacity during COVID-19 Pandemic taken average from quarter 3 (Q3) of 2019-20 to quarter-3 (Q3) of FY 2021-22.

According to respondent's quarterly assessment, average capacity utilization of the precision farming and plasticulture industry as plotted in Fig.9 revealed that impact of COVID-19 & lockdown has drastically impacted utilization capacity by 22.4% while comparing Q3 of 2019-20 (84.75%) with Q1 of 2020-21 (65.75%) i.e. in the period of first wave of the pandemic. Similar trend is noticed up to some extent in Q4 and Q1 respectively of FY 2020-21 & 2021-22 during second wave period that hit the country the hardest in terms of fatalities.

The second wave has led to further State-imposed lockdowns, impacting the economy while putting several restrictions in place on key businesses. This was followed by a slowdown in labour-intensive industries involving manufacturing on account of the reduced labour availability during this period. Strategic lockdowns



and easing up of the same with proactive measures, the country is slowly and steadily fighting against the insurgent second wave and the industry capacity utilization improved up to some extent and recovering the capacity utilization. They also highlighted the import export freight problems. Most of them stated that the freight charges for importing raw material have seen four to five times hike in recent past and some of the industry are already operating below 50 per cent of their capacity.

While extending the respondent view as plotted in Fig.9, manufacturer reveals that after experiencing subdued Q1 (Apr-Jun 2021-22), capacity utilization improved significantly in Q2 as well Q3. The percentage of respondents reporting higher production in all quarter when compared with first wave of Q1 2020-21. Most of the respondents expecting full capacity utilization by next couple of quarters.

The key issues stated by the respondent, which, influenced the manufacturing sector, are:

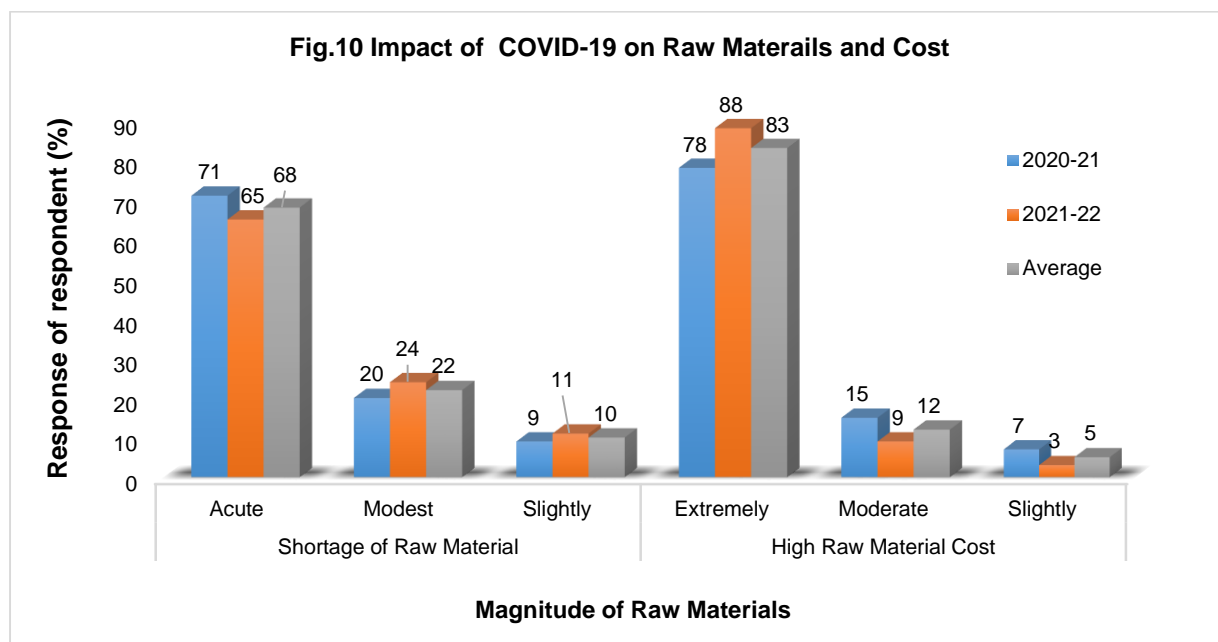
- Shortage of Raw material
- High raw material cost
- Liquidity crunch
- Less demand
- Supply Chain Disturbances
- Shortage of Skilled labours
- Movement restriction
- Special Regulatory Restrictions

### **3.4.2 Impact of COVID-19 pandemic on Raw Materials**

While deliberating with industry to assess the impact of COVID-19, 68% respondent's Industry stated that industry is one of the worst affected sectors wherein the manufacturers are facing acute shortage of raw material (Fig.10) during the pandemic that lead to the closure of many units across the country. According to Fig.10, 68% of Industry respondent's mentioned that industry is acute shortage of raw materials, 22% respondent stated modest shortage of quality raw material in both the financial year 2020-21 & 2021-22 during pandemic year that extremely affected the production level and which is pushing up its prices of raw material resulting higher production cost.

In past two years, India's polymer demand remained almost flat due to reduced factory activity, intermittent lockdowns and restriction in travel movement. With a huge surge in new COVID-19 cases in April - May 2021, popularly known as the second wave, consumer demand was badly hit. In 2020-21, the Indian polymer

industry (like global industry) was dominated by polyolefins (polyethylene or PE and polypropylene or PP), representing about 77 per cent of all commodity resins consumed.



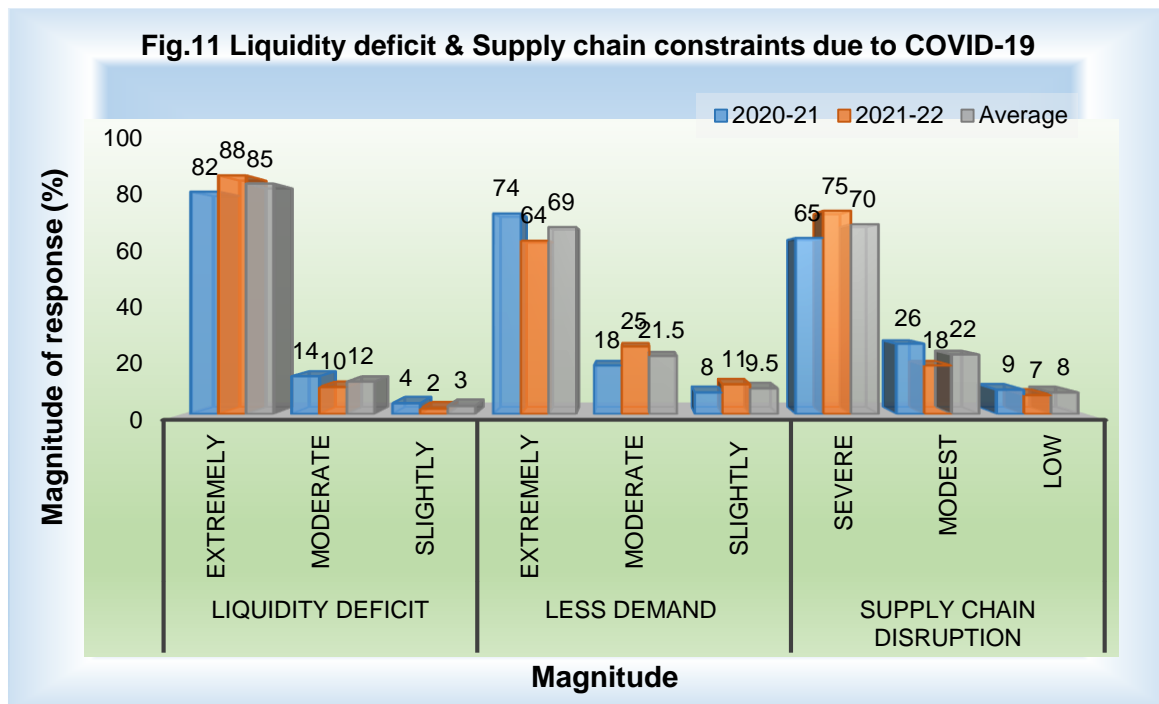
About 83% respondents mentioned that raw material cost is significantly increased; only 12% highlighted that the cost of raw material is moderately high during pandemic. Respondents expressed concern over steep rise in polymer prices and acute shortage in feedstock fearing it may lead to the closure of several units across the country. As the polymer raw material prices has severely hit Micro, Small and Medium Enterprises (MSME). Some of the respondent pointing out the prices have soared in the last 8-10 months during the pandemic period.

### 3.4.3 Impact on Import of Polymer

Polymer imports witnessed 25 per cent dip approximately in 2020-21, and is expected to remain around same level over the next two fiscals. In 2020-21 net trade deficit of total polymers stood at 1.85 million tonnes which was lower than previous year which stood at 2.79 million tonnes. It is expected to spike again in 2021-22 to touch 3.18 million tonnes and further to 3.32 million tonnes by 2023.

### 3.4.4 Impact of COVID-19 on Liquidity deficit, Demand & Supply chain

Liquidity Deficit during COVID-19 Pandemic: Fig.11 clearly indicates that precision farming and plasticulture industries extremely witnessed the liquidity deficit, over 85% and were unable to maintain the unit. The reason behind the deficit in liquidity as mentioned by all was cost increases of raw materials coupled with dictated by limited supply and burgeoning demand.



All the Industries have always needed to have a firm grip on their cash flows and liquidity requirements, as they have a number of areas to look after such as fixed overheads, machinery maintenance, labour cost, vendor payments, and other debt obligations. In order to maintain a constant source of liquidity, their customer payment side of the cycle needs to be stable. This has been challenged significantly in the current COVID-19 Pandemic, with lockdowns affecting the entire supply chain and also stretched payments from their customers due to variety of reasons. The respondent told that we have average collection period maximum for 60 days and in few industries even more, and this has resulted in manufacturing companies to either negotiate payment terms with vendors, restructuring/ enhancement of bank facilities or even letting go few large customer relationships due to liquidity deficit.

### 3.4.5 Supply chain disruption

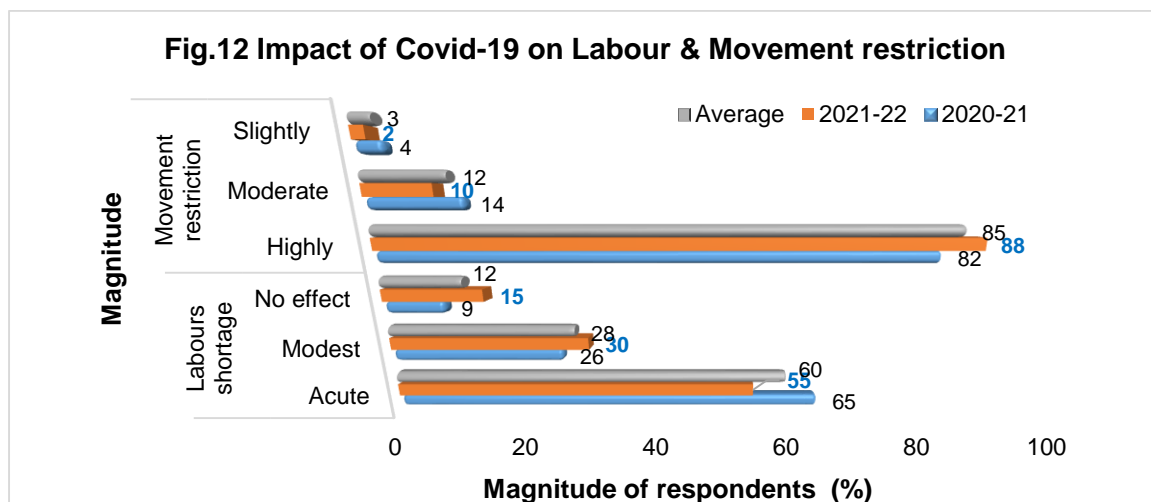
Due to the prolonged COVID-19 pandemic, 70% of respondents mentioned that industry had severely faced difficulty in operating routine business and supply chain activities. Variety of operational challenges includes liquidity crunch, delay, or halts in production activities, resizing the labour workforce, non-availability of raw material and low demand as mentioned by the 69% of the respondents (Fig.11). Industries are not able to meet the market targets and delivery schedules and less demand due to raw material crisis and higher cost. These issues have brought industries into a critical situation towards the right balance between survivability and sustainability, from a long-term perspective. The disruption caused by COVID-19 along the rapidly changing business environment coupled with the supply network complexity may trigger unforeseen disruptions and make supply chains vulnerable to financial losses and in extreme cases, unit leads to a shutdown situation.

### 3.4.6 Impact on working capital and employment

It is the most important factor as it explains 25.7% of the variation. The factor includes the variables, such as cancellation and postponement of pre-booked orders, difficulties in procuring raw material due to lockdown as well as cancellation of imports which will adversely impact the working capital of plastic as well as textile industry. Another major business issue involved in this is that there are many migrant workers working in the industrial segment. Owing to unemployment due of lockdown, they were forced to move to their native places. Thus, such workers will remain unemployed in the near future as well. There are many industries who had their goods in transit just before the announcement of the lockdown. Lockdown led to the stoppage of the goods in transit and entrepreneurs had no information regarding the status of delivery of their goods.

### 3.4.7 Labour shortage & Supply chain impact on Industry due to COVID-19

The plasticulture industry also highly impacted by acute shortage of labour and supply chain. 60% respondents of manufacturing Industry stated that the unavailability of skilled labour - which have moved back to their respective states - has led to significant pressure on the production, leading to underutilised capacity (Fig.12). Nationwide lockdown has caused enormous loss of jobs and livelihood for these workers. Some of the manufacturing unit in the country still won't take off due to an acute shortage of workers - who have still not returned from their home states as industry depend primarily on outstation employees for working their plants.



From the Fig.12, 60% of the respondent highlighted acute shortage of labour whereas 28% mentioned moderate effect of labour shortage and only 12% respondents mentioned that we have not faced labour crunch as we have retained the labour at high cost and operate the unit by maintaining the all the COVID-19 advisory. But the magnitude of response received from respondents, over 85% respondent revealed that restriction of vehicles and transport facility adversely affected the supply chain and liquidity crisis as well (Fig.12).

### 3.5 Government support to farmers during Pandemic

In-order to capture details regarding support received by the respondent growers NCPAH officials have contacted progressive farmers from all major states whether they have received any direct/indirect help from centre/state government/funding agencies/NGOs during pandemic lockdown period to continue agriculture/farming operations. During interaction, most of the farmers mentioned that they received any direct help from the government agencies. However, the polyhouse flower growers from Himachal Pradesh were happy to acknowledge that the Horticulture department of Himachal Pradesh sanctioned and distributed Rs. 30/- per sq.m. against losses due to lockdown. It was a great relief to Himachal Pradesh flower growers. Similarly, few farmer respondents from select states confirmed that transport facilities were arranged near farms to transport agriculture commodities to market place.

- Rs. 62,301.22 crores have been transferred to the Bank Accounts of **PM-KISAN** beneficiaries.
- **Kisan Rails** were operated for the first time from July, 2020 to facilitate movement of perishable Agri-Horticulture commodities.
- Central Sector Scheme of financing facility under Agri Infrastructure Fund. This scheme is operational from the year 2020-21 to 2029-30. The aim is creation of infrastructure at the farm gate.
- The **National Bee and Honey Mission (NBHM)** - Rs.500 crores from 2020-2021 to 2022-2023
- Concessional credit boost to 2.5 crore farmers through Kisan Credit Card. 174.96 lakh Kisan Credit Cards have been issued as part of the KCC saturation drive since February 2020 to 03.02.2021.
- **Pradhan Mantri Fasal BimaYojana (PMFBY)**, total claims of Rs.30802.02 crore have been settled for 256.29 lakh farmers during the COVID-19 pandemic from March 2020 to January 2021.

Government of India declared many schemes that benefitted farmers all over India during pandemic, which had benefitted many growers across the country. A brief of such is given in this section. The government of India announced the COVID-19 social assistance package of INR 1.7 lac crore (or 25 billion US\$) under the *Pradhan Mantri Garib Kalyan Yojana (PM-GKY)* to provide immediate relief to the vulnerable population. The PM-GKY package uses existing schemes to provide additional benefits to farmers and rural households. These schemes include *Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)*, *Pradhan Mantri Ujjwala Yojana (PM-UY)*, *Pradhan Mantri Jan Dhan Yojana (PM-JDY)*,

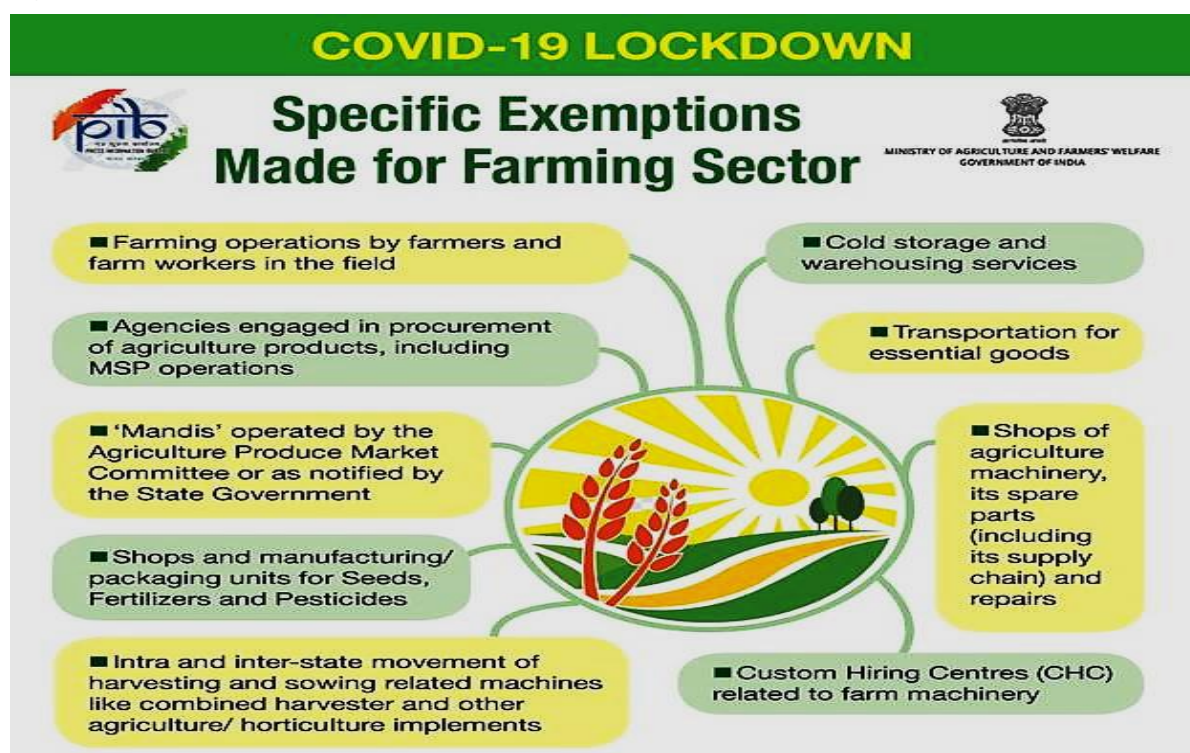
and *Pradhan Mantri Ann Vitran Yojana (PM-AVY)*. Together, these four programs represent about 70% of the total budget of the PM-GKY package.

The COVID-19-induced lockdowns triggered the biggest disruption of livelihoods in both the developed and developing world. In India, India's prime minister announced the lockdown on March 23, 2020. Subsequently, the economic activities have stopped in the country and affected the livelihood of 1.3 billion population. Although the government's price stabilization policies helped stability in cereal prices initially,



prices of essential commodities remained stable in May and June 2020 due to better supply chain management, and the procurement picked up in May and June, albeit with a slow start.

The time lag in the procurement of 2019–2020 Rabi season production may have influenced the liquidity concerns of farmers for the upcoming 2020 Kharif season (July-November). Moreover, the trading in the agriculture sector in India is mainly physical, and the farmers failed to receive the payments for their produce immediately after the transaction). At the same time, 85% of Indian farmers are marginal and small, 50% of farmers rely on informal credit, and 20% bought agricultural inputs on credit.



### Kisan Rail – A boon for farmers

In Union budget 2020-21, Govt. of India, has setup seamless national cold supply chain for perishables. These supply chain inclusive of milk, meat and fish, the Indian Railways will set up a “Kisan Rail” – through PPP arrangements with refrigerated coaches in Express and Freight trains as well for Farmers. These trains were especially for small and marginal farmers to sell their produce in markets beyond a certain distance, primarily due to factors such as non-availability of affordable transport, delay in transit resulting in damage/decay to produce, and unwillingness of road transporters to carry small sized consignments with any difficulties. The aim of Kisan rail was to have speedy movement of perishables to ensure minimum damage during transit and enable farmers to utilize the vast railway network to gain access to distant, bigger and more lucrative markets. Access to such markets will enable farmers to sell their produce at a better price, which will go a long way in fulfilling Government’s vision of ‘doubling farmers’ income.

### Salient Features:

- Vast network of Indian Railways enables farmers from remote villages to connect to the mainstream market and sell their agricultural produce.
- Saves times and encourages farmers to transport their perishables to greater distances and bigger markets.
- 50 percent subsidy is given in freight (being borne by Ministry of Food Processing Industries) for transportation of fruits and vegetables.
- Kisan Rails are based on the concept of multi commodity, multi consignor, multi consignee and multi stoppages – to help small farmers with lesser produce to transport their consignment without any middleman.
- There is no minimum limit on quantity that can be booked, enabling small farmers to reach bigger and distant markets. Execution: Railways have been pursuing with various stake holders to plan roll out of Kisan train services.



Based on demand pattern and feedback received from stakeholders, Railways have so far operated Kisan Rail services on 32 routes (till 12th Feb 2021) The first Kisan Rail Service was flagged off between Devlali (Maharashtra) and Danapur (Bihar) on 7 th August 2021 by Hon'ble Minister for Railways and Hon'ble Minister for Agriculture and Farmers Welfare.

For booking in Kisan rail, the farmers have to approach the Chief Parcel Supervisor of the Railway Stations from where the Kisan Rail service is scheduled to originate or to have enroute stoppage, along with their consignment. Due care is taken to ensure that the packing condition is not faulty. The consignment is weighed and charges are levied as per the prescribed parcel rates (P-scale). Subsidy of 50% on freight is given upfront to the farmers (i.e. they are charged only half the actual freight for the consignment). The subsidy is being borne by the Ministry of Food Processing Industries under their Operation Greens – TOP to Total scheme. Initially, the subsidy was on limited (notified) types/ categories of fruits and vegetables.

## CHAPTER – 4: Findings

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During the assessment, more than 150 progressive growers using plasticulture applications like Micro Irrigation, greenhouses, mulching, farm ponds etc., were contacted by NCPAH officials to understand how they have managed their farm operations and what were the various impediments/bottlenecks faced during the pandemic period. Due to pandemic situation and lockdown in 2020-21 and 2021-22 some months, farmers faced heavy losses and could not earn even 50% what they say to earn from their farming. The lockdown was declared in March 2020 that was relaxed after August 2020 and then again based on severe Covid-19 situations; states/districts administrations impose partial/complete lockdowns.

Various reasons for reduction in farm income came out while in discussions with farmers, which are listed as below:

**1. Lack of skilled workers** – It was informed by the respondent farmers that many of them specially those having polyhouses, shade net houses etc. use skilled workers for harvesting/post-harvest operations and other cultural operations like chemical sprays, irrigation & fertigation, crop management etc. Due to lockdown and restrictions in movements, the skill workers could not attend the works for about 3 months during 25<sup>th</sup> March 2020 to July 2020, many farmers could not harvest their produce in time and have to bear huge losses. The produce is not harvested in time and kept on crop itself, its quality is deteriorated and it affects next cycle of crop produce. Thus, non-availability of skilled workers caused heavy losses to the farmers during the lockdown period.

**2. Non availability of inputs** – During the first lockdown, the Krishi Seva Kendras were closed and hence farmers could not purchase inputs required for crop management like fertilizers, chemicals, growth promoters etc., those are required to maintain quality and growth of crop and produce. Thus due to unavailability of such inputs, farmers could not maintain desired quality of crop and produce which resulted in less production and significantly affected their income during the lockdown. It is informed that at some places, shops were open for some time but the inputs were sold at a very high rate and many farmers could not buy them due to high prices. However, local administration allowed to open the agri. input suppliers' shops in May 2021 that helped some farmers.

**3. Lack of transport facilities** - Some farmers informed that the workers were housed at farm itself and inputs was also not a problem. They could harvest in time their produce. However, in the initial days of lockdown, transport facilities were not available to carry the harvested produce from farm gate to wholesale market of

processing units. Due to lack of transport facilities, farmers have to throw the harvested produce on road or have to distribute the produce among workers, neighborhood etc., free of cost that resulted heavy losses. Some farmers mentioned that transport facilities like tempo, truck etc., were available to transport produce from farm to market but due to hike in petrol/diesel prices, the transport cost was also increased to very high and not affordable to common farmers. Again, farmers and transporters have to get a pass from local Administration for transport of Agriculture goods, which took additional expenses/time etc. Majority of the farmers faced the issue of transport specially those who used to send their produce in other states.

**4. Lack of buyers** – Due to lockdown, the regular buyers were not in a position to buy the harvested produce timely, as movement was restricted. The buyers were not sure of resell of the produce to whole sellers, retailers or consumers. In such situations, buyers either stopped completely to buy the produce or were asking the produce in a very low rate that caused losses to farmers. The buyers used to put a condition that the money will be given to farmers only if the produce is sold further and payments are received. The farmers were left with no option to either throw the produce or sell to available buyers at very low rates and waiting for the payments.

**5. Wholesale markets/retails/APMCs shut down** – Due to lockdown and restricted movements, majority APMCs, wholesale markets and retail markets were closed especially in rural areas that caused real huge losses to the farmers. Even when the local administration allowed to open the market for Agriculture produce, many shop owners, whole sellers were not ready to open the market to avoid risk of pandemic. From April 2020 to June 2020, the farmers suffered a lot due to unavailability of markets and they had to throw the rabi and summer harvests in garbage resulting in heavy losses.



**6. No export market for produce** – The rose growers in Pune and Bangalore region faced losses as export of roses stopped completely during lockdown. Growing roses for exports under protected structures is a very critical and skilled job. Lots of investment in infrastructure is required. In addition, huge investment in regular cultural operations day to day is mandatory resulting in increase in production cost of the produce. Since, roses are perishable, have to harvest, and sell immediately, delay in harvest, transport etc., and caused severe deterioration in quality resulting in losses.

These rose growers invested huge amount in development and maintenance of infrastructure and crop in polyhouses as they expect good returns from exporting



the roses to various countries especially to Europe, Singapore and Japan. During lockdown, rose growers managed to harvest flowers but transport facility was not available to take flowers from Mumbai airport to the desired destination. All International flights were stopped and no other facilities were available.

Major international flower markets like The Netherlands, France, England, Germany, Japan etc., were closed, as there was no demand from consumers. Thus, no demand, no markets, no transport facilities were available for rose exports during the lockdown. Rose growers in India especially Pune and Bangalore region were badly affected.

Rose crop is such a crop that unless you harvest the flower, another flower will not grow. Hence, farmers have to harvest the flowers whether there is demand or not. Such lakhs of rose flowers were harvested and thrown to garbage during March 2020 to July 2020 resulting in loss of approximately Rs. 200 Crores.

Same issue was with Gerbera growers in Maharashtra, Karnataka and other states. Though Gerberas are not exported and sold in Domestic market only, due to no demand in the market due to pandemic and lockdown, the farmers have to harvest and throw the flowers.



High air freight costs have deprived Indian floriculture exporters the opportunity to tap into the Valentines' Day demand (Photo credit -Voxmedia)

From July 2020 onwards, some flights to Europe from Mumbai were allowed and hence farmers hope to export roses then onwards. Unfortunately, the freight rates to sell the flowers overseas was increased significantly and farmers were unable to bear the hiked freight cost.

Hence, even with availability of transport, export of flowers could not take place. The market was good during Nov 20 to Feb 21 and farmers could earn some money. However, again there was second wave of pandemic that caused further severe losses. The losses were around 70%.

Furthermore, it is observed that among all the farmers in India, flower growers have to bear maximum losses whereas vegetable growers bear minimum losses. Flower growing is profitable in normal situations due to weddings, events like conferences, social gatherings, festivals etc.





## **Reasons for losses faced by Indian Precision farming & Plasticulture Applications Industry during/due to lockdown**

During the assessment, NCPAH officials had conversation to various Indian precision farming & plasticulture applications such as greenhouse erectors, greenhouse accessories /input suppliers, micro irrigation, digital agriculture and other components located in various parts of India on reduction in business due to lockdown since March 2020 until date. Following are the reasons highlighted by various stakeholders:

**1. High raw materials costs** – The costs of raw materials viz steel, plastics granules etc., have increased rapidly during lockdown that resulted in increased price of greenhouse structures. The farmers interested to have greenhouse structures chose to wait until the prices come to normal. It affected new business in pandemic period. For greenhouse erectors, it was also a challenge to complete the projects those were in the initial stage as the prices fixed on old raw materials cost and they have to complete the work with new increased raw materials costs resulting in heavy loss to greenhouse erectors.

**2. Transportation costs** – In the initial period of lockdown, entire movement was restricted and no transport facilities were available. The greenhouse fabricated pipes and other accessories those were ready to transport to field could not reach to field due to lack of transport facilities and investment in fabrication was a dead investment period. It affected business finance cycle that further affected future business as well.

**3. Non availability of skilled workers** – The construction of greenhouse is successful only when skilled workers are used for erection. Trained workers can complete the job in time and with perfection. Climbing on piped structure, fitting of polythene are skilled jobs and need specifically trained work force. Due to pandemic lockdown situation, the movement of workers was stopped completely for some months and hence the construction of greenhouses was delayed all over India causing losses to the erectors.

**4. Financial capacity of farmers** – During lockdown, farmers could not sell the produce due to various reasons as mentioned earlier and bear huge losses. Such farmers though willing to expand their greenhouse structures could not place orders for new greenhouses. Many of such orders were cancelled by farmers after the lockdown was imposed was observed by greenhouse fabricators. It was also observed that there was no disbursement of loans from the banks during the period and no subsidies were released. This also caused loss to greenhouse erectors.

**5. Adoption of plasticulture applications on last priority** – Because of uncertainties due to lockdown, investment in plasticulture applications was last priority for the farmers. The farmers were not ready to invest in such applications and willing to save available funds only for urgencies and emergencies. All these factors considerably reduced greenhouse erection business in India during lockdown and pandemic period.

## CHAPTER – 5: Suggestions & Way forward

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COVID-19 pandemic accompanied by a prolonged lockdown, call for alignment of agri-food policies and production systems to the new normal agriculture. Changes in rural labour markets have created an opportunity for diversification of agriculture, that may lead to a quantitative and qualitative improvement in natural resources and environment, reduce farm risks and enhance farm incomes.

During the assessment NCPAH officials contacted various stakeholders from Precision Agriculture & Plasticulture sector like farmers, Greenhouse fabricators, Micro Irrigation manufacturers, dealers & distributors of various inputs in Agriculture, Govt. officials, FPOs, Agriculture consultants, farmer's associations, plasticulture products manufacturers etc., regarding effects of pandemic.

The selected respondents of precision farming and plasticulture business were enquired to highlight the major factors including losses during lockdown, help and support from government agencies and their expectations from government authorities to avoid such situations in future.

The policymakers should convert labour crisis into an opportunity for diversification, by providing incentives for the adoption of new crops. For instance, the Government of Haryana has launched a scheme “*Mera Pani Meri Virasat*” (My Water My Heritage) that provides for a compensation of Rs. 7000 per acre to those farmers who diversify from paddy to maize, pearl millet, pulses and horticultural crops. In addition to that, the scheme provides for:

- (i) Purchase of cereal crops at their pre-announced minimum support prices (MSP),*
- (ii) no insurance premium for the proposed crops,*
- (iii) 85% subsidy on micro-irrigation equipment - the farmers have to pay only GST, and*
- (iv) 40% subsidy on pneumatic maize sowing machines.*

Similarly, the Government of Telangana has taken a bold initiative to regulate cropping patterns befitting the agro-ecological conditions. The Government of Telangana has linked this initiative to the existing “*Rythu Bandhu*” scheme —those who do not follow the specified cropping patterns will be denied monetary support of the scheme.

There is imperative need to evolve an incentive structure that can bring at par the comparative advantage of all the crops. It is also essential that farmers are assured of required supplies of inputs, credit, support services, and market for outputs. The emerging agri-market architecture should be inclusive of smallholder producers, who often face significant challenges in accessing inputs, services, credit and

markets. To enable smallholders, benefit from the market reforms, there is a need to promote collective action in the form of Farmer Producer Organizations (FPOs), self-help groups (SHGs) and cooperatives; and link these with agri-entrepreneurs or start-ups. Public-private partnerships in agricultural research need to be strengthened

Besides this, the views and suggestions made by stakeholders are given as below:

**1. Bank loan repayments/waiver** – The farmers who took loans for farming activities, have to repay in fixed time irrespective of any situation. Farmers requested to make the loans interest free during such lockdown situations. The loans should be relaxed until the situation recovers or in severe situations, waiver of loans is suggested by few respondent farmers in-order to meet their agri-expenses and losses incurred.

**2. Infrastructure creation at ground level** – It was observed that farmers growing perishable products like flowers, vegetables, fruits etc., were at a high risk and loss during lockdown period due to various reasons as mentioned earlier in this report. It was suggested by many farmers and industry that infrastructure like precooling chambers, cold storages, warehouses, Air-conditioned vans etc., should be constructed in local village areas specially vegetables and fruit growing pockets. This will help the farmers to address the problems of wastage of such perishable items and can give more returns to the farmers. Government to provide such facilities at a lower rate than the commercial rates.

**3. Minimum support price (MSP)** for all perishable Agriculture produce should be fixed by central/state government authorities based on production cost and it should be provided to farmers vide DBT system.

**4. Insurance against losses** during and due to such adversaries should be made available to the growers through IRDA registered/ leading companies and it should be distributed/released without any delay to the farmers. A user-friendly interface need be developed in local languages with ease of and without any cumbersome procedure for insurance claims.

**5. Provision for soft loans** many respondent farmers mentioned that due to losses faced during the pandemic. They were restricted to take new cultivation post pandemic, hence in case of such calamities, cost of investment for farming through soft loans/calamity funds should be provided to the farmers so that they may take up new cultivation in the next season.

**6. Accelerating adoption crop diversification** Government should accelerate adoption of hi-value crops with benefits of diversification to help farmers to adopt diversified cropping and to avoid over production and supply of single commodity in market having no demand or act as shortage of others.

**7. Relief for Floriculture Growers** - For flower growing farmers in protected cultivation, Government agencies should launch special campaigns for farmers in

such situation. Reduce additional taxes on fertilizers and chemicals. The interest for the next 3 years should be waived on the bank loan of the farmers in greenhouse sector.

**8. Financial assistance /subsidy** on plasticulture products/precision technologies should be disbursed timely. During interactions, it was brought to notice that the subsidy was sanctioned but was released after 2 to 3 years from the date of sanction. Hence, it is suggested that at least in such situations, subsidies should be released with top priority in order to support the farmers.

**9. GST reduction on agri-inputs** It was suggested by the respondents that in-order to support the sector taxes on fertilizers, pesticides, plasticulture applications like greenhouses, Micro Irrigation, mulching etc., should be reduced/revised.

**10. Free energy** Majority of the respondents suggested that electricity expenses used for farming activities should be made available free of cost during such situations to lower the burden of growers.

**11. An Agricos farmer** (Graduate in Agriculture) suggested that government agencies/NGOs/FPOs could donate vegetable processing units to farmers or villages where vegetable cultivation is a major field activity. There are many such vegetable growing hubs near big cities like Pune, Bhopal, Delhi, Ahmedabad, Bangalore etc.

For example, a tomato growing area may be considered and small tomato processing units may be provided as incentive to the villages/FPOs in that area. During such lockdown situations, when movement of raw vegetables supply is restricted, such small processing units may be of importance to the vegetable growers and farmers can save their produce from wastage.

There are many such small-scale processing units available with private/government agencies like Central Institute of Post-Harvest Engineering & Technology (CIPHET) Ludhiana from where such units could be procured and supplied.

**12. Low cost or zero energy cold storages** can be constructed at every village or group of farmers that could be used to store perishable products during lockdown and no transport situations. Such initiatives can save wastage of vegetables at village level and can improve the economic conditions of the farmers.

**13. Vermi composting** should be promoted at large extent so that lack of fertilizers etc. will not cause much harm to the produce. Low-cost structures should be promoted. Solar dryers, solar pumps etc. should be made available in common use at village level.

### **Suggestions from Greenhouse/ Nets house Industry**

During the interactions with the greenhouse & Shadenet house fabricators, input suppliers, greenhouse film producers many suggestions were made by the leading

industry players on how farmers can increase their income adopting polyhouse cultivation round the year and situations like pandemics. The views expressed by the industry is given as follows:

**1.** It was informed that most of the farmers who have erected the polyhouses under NHM/NHB schemes, pay the fabricators/company after the subsidy is released by the nodal agency in their name. The greenhouse fabricators have to wait for their payments until subsidy is released to the farmers by nodal agency. If the subsidy is not released in time, their economic cycle is disrupted influencing their future business.

Hence, it is suggested that the release of subsidy should be made once the greenhouse construction work is completed. During lockdown period, entire movement halted and subsidy releases were delayed by nodal agencies due to lower work force and restricted work hours for processing of cases.

**2.** Greenhouse construction and plasticulture applications business completely depend upon economic status of the farmers and funds available through government subsidy schemes for adopting these capital intensive applications. Hence, it is suggested that government agencies need to provision appropriate funds and its timely disbursement to farmers to keep precision farming and plasticulture business alive.

**3.** The rates and subsidies for plasticulture applications/greenhouses etc., is fixed by government agencies in 2013-14. However, same rates still exist for subsidy calculations. During the years, prices of raw materials like steel, HDPE, PVC, LDPE etc., increased from 50% to 90% in some cases resulting an increase in the price of final product. The raw materials prices are increased heavily specially during lockdown period. Though the prices of greenhouses and other plasticulture products are increased, there is no increase in subsidy by the government agencies for the farmers. Such high rates caused less interest of farmers buying these products that really hampered the business. It is therefore suggested that Government agencies should revise subsidy norms as per market rates and it should be revised at least once in Two years.

**4.** As stated above, the rates of steel and plastic raw materials increased up to 80% during lockdown because of various reasons. It is expected that during such critical situations, government agencies should make necessary arrangements to keep and maintain reasonable rates of such raw materials that will help farmers as well as plasticulture business.

**5.** GST for plasticulture products is in between 12% to 18% for majority of the products. Since these products are used in agriculture by farmers, it is suggested that the GST for all plasticulture products should be between 0 to 5% maximum. This will also help in reducing prices and increase in demand.



## Annexures

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- I. Questionnaire for progressive farmers
- II. Questionnaire for MI/Automation/Digital Agriculture Industry
- III. Questionnaire for plasticulture industry
- IV. List of PFDCs

**Questionnaire for progressive farmers**

1. Basic info – Name, address, area irrigated or non-irrigated
2. Type of precision Agriculture/plasticulture he is using
3. Since when, why and how it impacted on his financial status
4. Income in 18-19 (before pandemic)
5. What is the effect of pandemic on his farm activities (planting to marketing, inputs availability etc.).
6. If the effect is negative, what he did to survive
7. What is the experience of his neighbor farmers, friends etc.
8. Any help from government agencies, NGOs, others
9. Expectations from government agencies
10. Learnings from pandemic

**Questionnaire for MI/Automation/Digital Agriculture Industry**

1. Company's Name: \_\_\_\_\_

2. JVs/Acquisitions/Self (if any)  
\_\_\_\_\_

3. No. of years in business: \_\_\_\_\_

4. Area/Region of operation:  
\_\_\_\_\_

5. Type of company(Manufacturing/Dealership/Partner) \_\_\_\_\_

6. No. & type of units installed during

2018-19	2019-20	2020-21
---------	---------	---------

7. Estimated Turnover: Present \_\_\_\_\_ Cr. before  
pandemic \_\_\_\_\_ Cr.

8. Business Volume (lakh Rs.)/Area covered (ha.)

2018-19	2019-20	2020-21
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9. Reasons or impediments observed for low business  
\_\_\_\_\_

10. Suggestions/Support from Govt/State  
\_\_\_\_\_

11. Any issues to be addressed  
\_\_\_\_\_

**Questionnaire on agro-Textiles Industry**

1. Name of firms: -----
2. Year of establishment: -----
3. Address: -----
4. Contact Person Name & Contact No: -----
5. JVs/Acquisitions/Self (if any) -----
6. Area of Operations: -----
7. **Other Products Processed:** -----
8. Technical Specifications of the products:
9. Raw materials used: -----
10. Estimated Turnover: Present \_\_\_\_\_Cr. before pandemic \_\_\_\_\_Cr.
11. Production cost increase/decrease during Pandemic?
12. What are the principal direction of your business development strategies during COVID-19?
13. Transportation/ Supply of materials to clients
14. Marketing strategies
15. Govt. Support, if any during COVID-19 Pandemic:
16. Post COVID-19 strategies of the business?
17. Reasons or impediments observed for low business: -----
18. Suggestions/Support/ Expectation from Gol/ State: -----
19. Any other business issues to be addressed\_-----

## Annexure-IV

### Address of Precision Farming Development Centres (PFDCs)

S.N.	State	Location	Address
1	Assam	Guwahati	Precision Farming Development Centre, Horticultural Research Station, Assam Agricultural University, Kahikuchi P.O- Azara, Guwahati - 781017 <b>Assam</b>
2	Bihar	Pusa, Samastipur	Precision Farming Development Centre, Dept. of Soil & Water Conservation Engineering, College of Agricultural Engg., Dr. Rajendra Prasad Central Agriculture University, Pusa (Samastipur) - 848125 <b>Bihar</b>
3	Chhattisgarh	Raipur	Precision Farming Development Centre, Dept. of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar, Raipur- 492 006 <b>Chhattisgarh</b>
4	Gujarat	Navsari	Precision Farming Development Centre, Soil and Water Management Research Unit, Navsari Agricultural University, Navsari – 396450 <b>Gujarat</b>
5	Haryana	Hisar	Precision Farming Development Centre, Dept. of Horticulture, College of Agriculture, CCS Haryana Agril. University, Hisar - 125004 <b>Haryana</b>
6	Himachal Pradesh	Solan	Precision Farming Development Centre, Dept. Soil Science & Water Management, Dr. Y.S. Parmar University of Hort. & Forestry, Solan, Nauri – 173 230 <b>Himachal Pradesh</b>
7	UT of Ladakh	Leh	Precision Farming Development Centre, SKUAST-K- HMAARI, P.O. Box No. 146, Leh, Ladakh – 194101 <b>UT of Ladakh</b>



8	Jharkhand	Ranchi	Precision Farming Development Centre, Dept. of Agril. Engineering, Birsa Agricultural University, Ranchi, P.O.- Kanke, Ranchi – 834006 <b>Jharkhand</b>
9	Karnataka	Bangalore	Precision Farming Development Centre, Division of Horti., UAS, GKVK, University of Agricultural Sciences, Bangalore - 560065 <b>Karnataka</b>
10	Kerala	Tavanur	Precision Farming Development Centre, Kerala Agricultural University, Kelappaji College of Agril. Engineering & Technology, Tavanur - 679573 Malappuram District, <b>Kerala</b>
11	Madhya Pradesh	Bhopal	Precision Farming Development Centre, Division of Irrigation and Drainage Engineering, Central Institute of Agricultural Engg. (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462038 <b>Madhya Pradesh</b>
12	Maharashtra	Rahuri	Precision Farming Development Centre, Dr. A.S. College of Agricultural Engineering, Mahatama Phule Krishi Vidyapeeth, Rahuri– 413722, Distt. Ahmednagar <b>Maharashtra</b>
13	Manipur	Imphal	Precision Farming Development Centre, Department of Horticulture, College of Agriculture, Central Agricultural University, Iroisemba, Imphal – 795004 <b>Manipur</b>
14	New Delhi	New Delhi	Precision Farming Development Centre, Water Technology Centre, Indian Agricultural Research Institute (IARI) <b>New Delhi -110012</b>
15	Odisha	Bhubaneshwar	Precision Farming Development Centre, Dept. of Horticulture, Odisha University of Agriculture and Technology (OUAT), Bhubaneshwar - 751 003 <b>Odisha</b>
16	Punjab	Ludhiana	Precision Farming Development Centre, Dept. of Soil and Water Engg., College of Agricultural

			Engg. & Technology, Punjab Agricultural University, Ludhiana-141004 <b>Punjab</b>
17	Rajasthan	Bikaner	Precision Farming Development Centre, Agriculture Research Station, Beechwal Swami Keshwanand Rajasthan Agricultural University, Bikaner- 334006 <b>Rajasthan</b>
18	Tamil Nadu	Coimbatore	Precision Farming Development Centre, Dept. of Soil & Water Conservation Engg., Agricultural Engineering College and Research Institute, Tamil Nadu Agricultural University, Coimbatore - 641003 <b>Tamil Nadu</b>
19	Telangana	Hyderabad	Precision Farming Development Centre, Water Technology Centre, PJTSAU, Rajendranagar, Hyderabad - 500030 <b>Telangana</b>
20	Uttar Pradesh	Lucknow	Precision Farming Development Centre, ICAR-Central Institute for Subtropical Horticulture (CISH), Division of Crop Production, Rehmankhera, P.O. Kakori, Lucknow - 226101 <b>Uttar Pradesh</b>
21	Uttarakhand	Pantnagar	Precision Farming Development Centre, College of Technology, Dept. of Irrigation & Drainage Engg., GB Pant University of Agriculture & Technology Pantnagar -263145, Distt.- Udham Singh Nagar <b>Uttarakhand</b>
22	West Bengal	Kharagpur	Precision Farming Development Centre, Dept. of Agricultural & Food Engg., Indian Institute of Technology, Kharagpur - 721302 <b>West Bengal</b>



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