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MARKET VULNERABILITIES AND POTENTIAL OF HORTICULTURE CROPS IN INDIA: WITH SPECIAL REFERENCE TO TOP CROPS

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India is the second largest producer of fruits and vegetables in the world, contributing about 9.3 per cent share of total world production. In 2020-21, the production of horticultural crops has been pegged at a record 326.6 million tonnes (MT) which is more than total foodgrain production. The production of vegetables, especially tomato, onion and potato has increased significantly over the years, making India the second largest producer of all the three vegetables in the world. Increase in production of TOP crops are mainly due to increase in area while productivity is stagnant. Horticulture is increasingly recognised as a sunrise sector, owing to its potential to raise farm income, provide livelihood security and earn foreign exchange through export. However, marketing of horticulture faces major problems like large post-harvest loss, lack of infrastructure development, price seasonality and volatility, etc. In this paper, we try to understand trends in overall production, price volatility and issues related to marketing of horticulture produce with special emphasis on TOP crops. Historical price volatility measurement of TOP crops suggest that price volatility is highest among the onion followed by tomato while price seasonality is highest in tomato. As potato has the highest storage capacity, it has lowest volatility among the TOP crops. Horticulture has been recognized as one of the rapidly growing and evolving sectors having the potential to lead us to our goal of doubling farmer's income by 2022 through backward and forward linkages. Unless the increase in production is met with sizeable increase in cold storage capacities and transportation to the consumer base, the farmers will not be able to receive their fair share of income. Government of India has taken various initiatives to address the problems pertaining to horticulture sector like Operation Green, Agriculture Infrastructure Fund, PM Kisan SampadaYojana, etc.

Keywords: *Trends in horticulture production, TOP crops, Price seasonality and volatility.*

INTRODUCTION:

India is the second largest producer of fruits and vegetable in the world, contributing about 9.3 per cent share of total world production. It is the largest producer of several horticultural commodities like mango, banana, okra, papaya, lime & lemon making it an important country in the horticulture sector. Even though fruits and vegetables occupy only 4.9 percent* of the gross cropped area of India, value of output exceeds that of cereals. Over the years, horticulture has overtaken foodgrains output and today it is contributing a higher share to agricultural GDP and earning higher foreign exchange value. In 2020-21, the production of horticultural crops has been pegged at a record 326.6 million tonnes (MT) as per the First Advance Estimates - 1.8 per cent higher than the final estimates of 2019-20 (320 MT). The production of vegetables, especially tomato, onion and potato has increased significantly over the years, making India the second largest producer of all the three vegetables in the world. During 2020-21, tomato, onion and potato production was 20.1 MT, 26.2 MT and 53.1 MT, respectively.

However, this does not bring much optimism to the vegetable farmers. Reeling under over production, they are resorting to distress sales, burning their crop or discarding them on roads. The current market situation begs the question as to why, despite record levels of production, we have not been able to do justice to our farmers. The market of horticulture crops are characterised in India by fragmentation, high price volatility, substantial quality and quantity losses and low levels of processing. Prevalence of these problems has not only weakened India's potential in global trade of horticultural crops, but also resulted in low returns to the farmers growing these high value crops.

Unlike cereals and dairy, where procurement and marketing is quite developed, a decent value chain in fruits and vegetables is missing. The reason for that lies in the perishable nature of the crop, regional and seasonal concentration, associated losses and lack of storage infrastructure facilities.

It is essential, therefore that the fruits and vegetable value chain be made market demand- driven, where the farmers do not face the problem of plenty. In order to do this, it is imperative that various kinds of losses, wastages and inefficiencies along the value chain be reduced. First step in this regard would be to minimise harvest and post-harvest losses, by bridging the storage infrastructure deficit and correcting the spatial mismatch. Secondly, we need to eliminate the inefficiencies in

** Data have been taken from Land Use Statics (LUS) for comparing area under different crops, even though there is anomaly in horticulture acreage data in LUS and Horticulture Statistics.*

the marketing chain by considering alternate marketing models or channels. In a typical fruits and vegetable value chain, high margins appropriated by intermediaries lead to low share of the farmer in consumers' rupee. Innovative models like linking organised retail directly with farmers, farmer-consumer markets, contract farming and so on, have come up as a solution. Since Agriculture is a state-subject, the states play a key role in ushering in these reforms. Finally, developing markets for the farmers is also crucial in ensuring stable and profitable remuneration. To this end, efforts have to be made in earnest to develop our processing abilities and export market for both fresh and processed fruits and vegetables. This paper is an attempt to analyse the changing pattern and trends in the growth of the horticulture sector, the lessons that can be imbibed from the growth saga hitherto and suggest broad policy contours required to further the horticultural growth in tune with changing demands. An attempt has also been made to focus on the issues in the present horticulture marketing channels. The vulnerability and volatility in prices of horticulture commodities is also brought out with special emphasis on the Tomato, Onion and Potato (TOP crops).

DATA AND METHODOLOGY:

The paper uses mainly secondary data collected from various government sources. Data on production were collected from Horticultural Statistics at a Glance, 2018, a Ministry of Agriculture and Farmers' Welfare publication, and area under different crops was taken from Land Use Statistics data, Directorate of Economics and Statistics, Ministry of Agriculture and Farmers' Welfare. An attempt has been made to capture the trends in the area, production and productivity of horticulture crops in India. Through standard statistical tools, we try to bring out the extent of price volatility of the TOP crops besides highlighting other major issues with marketing of horticulture crops. Paper has used historical volatility model to calculate price volatility. Historical volatility is the range of price of a commodity over the period in the past. Historical volatility permits us to realise price behaviour under known market conditions.

FINDINGS AND DISCUSSION:

Overview of the Horticulture Economy in India:

Horticulture is increasingly recognised as a sunrise sector, owing to its potential to raise farm income, provide livelihood security and earn foreign exchange through export. The diverse agro-climatic conditions and rich diversity in crops and genetic resources enable India to produce a wide range of horticultural crops round the year. To cite an example, India produces a tropical fruit like mango and sub-tropical fruit like apple at same season in a year. Horticulture sector encompasses a wide range of crops

like fruits, vegetables, flowers, spices, plantation crops like coconut, beverages like tea and coffee and some medicinal and aromatic plants (Jha et al, 2018).

India is the second largest producer of fruits and vegetables and contributes 9.3 per cent of the world's total fruits and vegetable production. India's position in the world in major horticulture crops is given in Table 1.

Status of Horticulture in India:

Horticulture production in India has more than doubled from 146 MT in 2001-02 to 326.6 MT in 2020-21 whereas the production of foodgrain increased from 213 MT to 305.4 MT tonnes during the same period. India is now self-sufficient in foodgrain production and is the largest global producer of farm products like pulses, jute, buffalo meat, milk, and poultry. It is also the second-largest producer of several horticulture products, especially fruit and vegetables. The National Horticulture Mission (NHM), a centrally sponsored scheme, was

Table 1
India's Position in the World in Major Horticulture Crops

(Million Tonnes)

Items	India	World	India's	
			% Share	Rank
Fruits & Vegetables				
Vegetables & Melons	120	1075	11.2	Second
Okra	5.5	9	62	First
Potatoes	44	377	11.6	Second
Tomato	18.4	177	10.4	Second
Onion (dry)	19.4	93.2	21	Second
Cabbages & other Brassicas	9	71.2	12.3	Second
Cauliflower & Broccoli	8.2	25.2	32.5	Second
Brinjal	12.6	51.3	24.5	Second
Fruits excluding Melons	91	866	10.5	Second
Banana	29.1	113.2	25.7	First
Mango, Mangosteen and Guava	18.8	46.5	40.4	First
Lemon & Lime	3	17.3	17.2	First
Papaya	5.6	12.6	44.4	First
Total Fruits (excluding melon)	***90.9***	***865.9***	***10.5***	***Second***
Total Vegetables (including melon)	***119.9***	***1075.2***	***11.2***	***Second***

Source: Horticulture Statistics at a Glance, 2018.

launched in 2005-06 with one of its major objectives being to increase horticulture production and doubling farmers' income. Just before the launch of the NHM, the production of horticulture crop was about 167 MT, using only 9.7 per cent of the cropped area (18.5 million hectare), the total foodgrain production was 198 MT, covering 63 per cent (120 million hectare) of total crop area of the country. Horticulture has registered a sharp rebound in production and acreage, far outpacing the foodgrain production since 2012-13. In 2012-13, total horticulture production at 269 MT, surpassed total foodgrain production at 257 MT. The area under horticulture crops increased to 25.5 million hectare in 2018-19, which is 20 per cent of the total area under foodgrain, and produced 314 MT. However, the area under total foodgrain declined from 129 million hectare in 2016-17 to 124 million hectare in 2018-19.

The most notable factor behind this is that the productivity of horticulture has increased from 8.8 tonnes per hectare in 2001-02 to 12.3 tonnes per hectare in 2018-19 while the productivity of total foodgrain increased from 1.7 tonnes per hectare to 2.3 tonnes during the same period. Higher productivity in horticulture as compare to foodgrains caused more production of horticulture crops than foodgrains (Table 2). Horticulture crops are characterised by high-value crops, higher productivity per unit of area and lower requirement of irrigation and input cost. Table 3 indicates area and production of major horticulture crops.

Table 2
Production of Horticulture vis-à-vis Foodgrains

Triennium Ending	Production (In Million Tonnes)	
	Total Horticulture	Total Foodgrins
TE2005-06	167.7	206.7
TE2008-09	205.9	227.5
TE2011-12	240.3	240.6
TE2014-15	275.7	258.2
TE2017-18	295.8	270.5
TE2020-21	315.9	285.2
CAGR (%)	4.34	1.87
CV (%)	25.64	14.33

Note: Fourth Advance estimates for the year 2019-20 and First Advance Estimates for the year 2020-21 are used to calculate TE2020-21.

Source: Foodgrains: Directorate of Economics and Statistics; Horticulture: NHB.

Table 3
Production of Horticultural Crops

Particular	TE2020-21	
	Area (Million ha)	Production (MT)
Fruits	6774	101074
Vegetables	10362	188562
Tomato	806	20109
Onion	1415	25067
Potato	2157	50622
Aromatic and Medicinal Plants	640	780
Flowers	315	2901
Plantation Crops	4087	16014
Spices	4276	10014

Note: *Honey production at TE2020-1 is 120 MT while area data for the same is not available.*

Source: *Area and Production of Horticulture Crops for 2020-21 (1st Advance Estimate [AE], National Horticulture Board, Ministry of Agriculture and Farmers' Welfare, Government of India.*

In 2020-21, the production of horticultural crops has been pegged at a record 326.6 million tonnes as per the first AE, 1.8 per cent higher than the final estimates of 2019-20. This was driven mainly by the step-up in production of fruits and vegetables. Production estimates for aromatics, medicinal plants and plantation crops have also been pegged higher than the previous year by 10.6 per cent. Among the three key vegetables (TOP), – production of potatoes and onions has jumped by 9.4 per cent and 0.8 per cent, respectively, spurred by increased acreage. This may soothe price pressures going forward. Tomato production has fallen by 4.8 per cent, despite an increase in acreage because of the price crash during the COVID-19 induced lockdown leading to lower realisation by farmers.

Trends in Area, Production and Productivity of TOP Crops:

Although Indian farmers grow 175 varieties of vegetables but tomato, onion and potato contribute 51 per cent of total vegetable production in which potato contributes maximum 27 per cent followed by onion (13.5%) and tomato (10%). The area, production and productivity of TOP crops grew continuously at the All-India level during the last 10 years. Onion production has increased from 14.9 MT during TE 2011-12 to 25.3 MT during TE 2020-21. Similarly, tomato production has increased from 16.0 MT in TE2011-12 to 20.2 MT in TE2020-21and Potato production increased from 40.1 MT in TE2011-12 to 50.7 MT in TE2020-21. All three crops have also shown an increase in productivity over the same period (Table 4).

Table 4
Area, Production and Productivity of TOP Crops

Area: 000'ha
Production: MT

Triennium Ending	Onion			Tomato			Potato		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
TE2011-12	969	14.9	15	802	16.0	20	1869	40.1	21
TE2014-15	1143	18.4	16	843	17.8	21	2014	45.0	22
TE2017-18	1304	22.2	17	787	19.7	25	2146	47.8	22
TE2020-21	1430	25.3	18	805	20.2	25	2147	50.7	24
CAGR (%)	4.8	6.4	1.5	0.1	3.0	2.9	1.6	2.7	1.2

Source: National Horticulture Board, Ministry of Agriculture and Farmers' Welfare, Government of India.

Table 4 suggests that increase in production in TOP crops are mainly due to increase in area especially in onion. Productivity of onion has just increased by cumulative growth of 1.5 per cent while CAGR of tomato and potato productivity is 2.9 per cent and 2.7 per cent, respectively. Productivity in onion needs to be increased through high quality seed intervention and decrease in the impact of excessive rain through better rainwater harvesting techniques.

Issues with Horticulture Marketing:

Marketing of horticultural crops is quite complex and risky due to the perishable nature of the produce, seasonal production and bulkiness. The spectrum of prices from producer to consumer, which is an outcome of demand and supply of transactions between various intermediaries at different levels in the marketing system, is also unique for fruits and vegetables. Moreover, the marketing arrangements at different stages also play an important role in price levels at various stages viz. from farm gate to the ultimate user. These features make the marketing system of fruits and vegetables to differ from other agricultural commodities, particularly in providing time, form and space utilities. While the market infrastructure is better developed for foodgrains, fruits and vegetables markets are not that well developed.

MAJOR ISSUES:

a) Post-Harvest Losses:

The food loss is segmented into 3 categories: Production loss, post-harvest loss, and retail and consumer loss. The post-harvest period exists from the time the food is harvested till the time it reaches retails markets for consumption. Post-harvest loss of food is defined as the measured loss of quantity and quality in the harvested food commodity before it reaches the retail market. According to UN's FAO report, globally around 1.3 billion metric tonnes of food, which is 33 per cent of the total produce, is lost in the post-harvest stage and it predicts that if the current practices continue then the loss would be around 2.1 billion metric tonnes by 2030. In India, as per the latest report, food worth of Rs.92651 crore is lost in post-harvest processes before it reaches the consumer. This monetary value is approximately 40 per cent of the total produce in India, making India one of the few countries to have higher post-harvest losses while the government spending is just about 1 per cent of the country's GDP in food distribution.

India is the second largest producer of fruits and vegetables in the world with a combined production of about 326.6 MT during 2020-21. The post-harvest processes for fruits and vegetables involves harvesting, sorting and grading, transportation to pack-houses and cold stores, storage and then transporting to

the retail market. There are a multitude of challenges and problems in this area, which give rise to the losses and opportunity to curb them.

A comparative study by the Central Institute of Post-Harvest Engineering and Technology (CIPHET), Ludhiana ((2015), reported that about 16 per cent of fruits and vegetables are lost in the post-harvest. While it is important to focus on reducing food loss across various different commodities, this huge gap emphasises the need to focus on reducing wastage in the fruits and vegetables sector. Among major agriculture produce, wastage is maximum in fruits and vegetables followed by fisheries and poultry. Wastage in fruits and vegetables varies from 4.58 to 15.88 per cent. While, cumulative wastage in cereals and pulses range between 4.65 to 8.44 per cent and in oilseeds the range is 3.08 to 9.96 per cent.

Within the total horticulture crops, the post-harvest losses is amongst the highest in the TOP crops. The post-harvest losses are the highest in tomato (12.44%) followed by onion (8.2%) and potato (7.32 %) and the same is presented in Table 6.

b) Infrastructure Availability

In India, because of imperfect coordination between supplies and demand, seasonality and perishable nature of horticulture crops, storage plays an important role in the marketing. Cold storage infrastructure is one of the most important factors in the post-harvest process because it is where the commodity spends most of its lifetime. In India, there are about 7600 cold storages which account for 34.9 million metric tonnes of storage capacity but their distribution is inequitable among the states. Around 59 per cent of the storage capacity, which comes to 21 million metric tonnes, is present only in the 4 states of Punjab, Uttar Pradesh, Madhya Pradesh and Gujarat. Of the cold storages, 96 per cent are privately run and government bodies, institution and co-operatives run the rest. About 75 per cent of the cold stores are dedicated only for potatoes, which signify the dearth of availability to other products while also stressing the importance of potatoes for Indian consumers. About 5000 cold stores that were built much before have no integrated pack houses or ancillary units to assist food storage. Most of these cold stores are located very near to the production centres and thus depend heavily on transportation to reach the consumers.

A cold storage of about 5000 metric tonnes requires an initial capital investment of about Rs.40 million excluding land. The high real estate costs lead to setting up of cold storages very far from the urban centres. Electric power is another major factor that adds to the problems in setting up stores in the initial stages. India experiences

Table 6

Harvest and Post-Harvest Losses of TOP Crops at National Level *(In %)*

Crop	Operations					Total Loss In Farm operations	Storage Channel					Total Loss in Storage	Over-all Total Loss
	Har-vest-ing	collec-tion	Sort-ing/ Grading	Pack-aging	Trans-port		Farm	Gow-down/ Cold Store	Whole-saler	Re-tail-er	Pro-cesing Unit		
Onion	2.62	0.44	2.35	0.12	0.51	6.05	0.35	0.3	0.77	0.72	0.01	2.16	8.21
Potato	2.58	0.25	2.93	0.06	0.72	6.54	0.15	0.17	0.34	0.11	0.02	0.78	7.32
Tomato	3.16	0.52	3.74	0.24	1.75	9.41	0.12		1.26	1.63	0.02	3.03	12.44

Source: CIPHET (2015).

about 9 per cent peak power deficit even today and this forces majority of the cold stores to run on backup power using diesel or kerosene, which raises the cost of storage and the operational costs. From a technical standpoint, a multi-commodity cold storage requires different conditions such as temperature and humidity for each commodity and there are not enough efficient systems to handle that in a cost-effective manner. This results in many of the cold storages being single commodity facilities that helps in bringing down the operational costs because of scale. There is also a marked paucity in the availability of advanced systems that helps in increasing the shelf life of the commodity stored inside the storage.

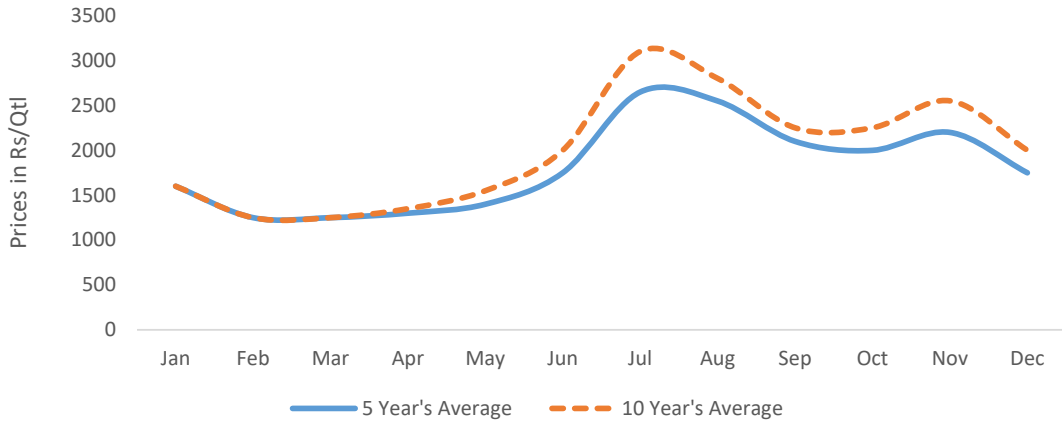
c) Prices and Market Volatility

All India Price Seasonality

Prices of agricultural commodities fluctuate in accordance with their supply and demand situation, which, in turn is characterised by seasonality of production and marketing. Horticulture commodities are produced seasonally and are perishable. On account of these characteristics, such commodities register fluctuation of prices from month to month. All India seasonality of Tomato, Onion and Potato crops on 10 years average and 5 years average is given in Figures 1, 2 and 3, respectively.

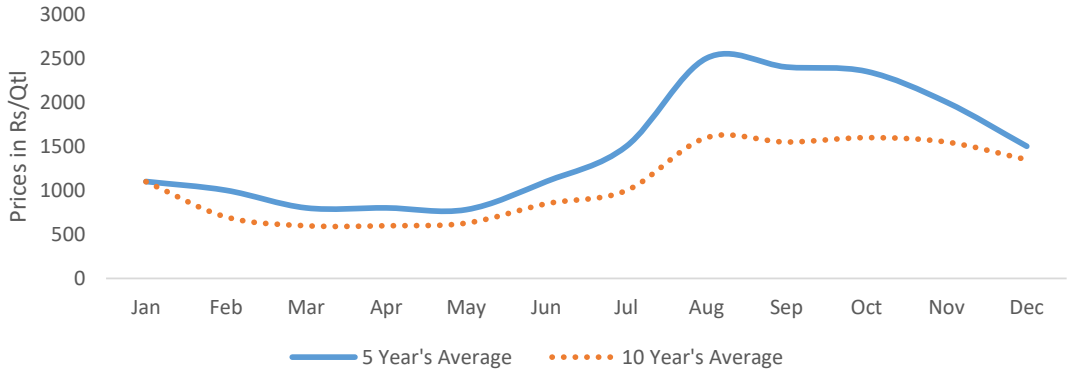
Figure 1 revealed that tomato prices are highest during the period of July to August as this period is the lean production period. December to March is the period when tomato prices are trading at their lowest. Among the TOP crops seasonality in tomato price is maximum because of higher perishability.

Figure 1: All India Price Seasonality of Tomato



Source: agmarknet.gov.in

Figure 2: All India Price Seasonality of Onion



Source: agmarknet.gov.in

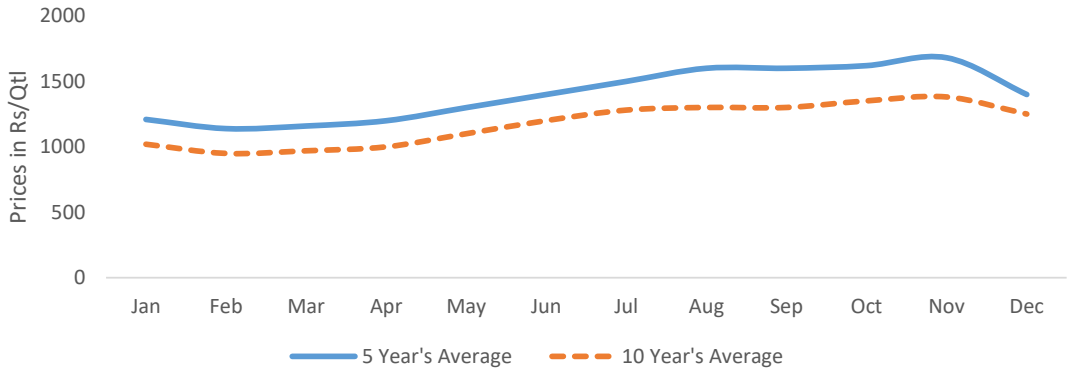
Figure 2 indicates that onion prices starts moving upward from July because rabi crop arrivals have ended by this time and the country completely relies on rabi stocks till September. Prices start coming down in October as fresh kharif and late kharif crop starts arriving in the market from major onion producing states, i.e., Maharashtra and Karnataka. In August–September, a smaller quantity of crop also comes from Andhra Pradesh and plays a significant role in controlling the high prices. Thus, any damage to the onion crop in Andhra Pradesh or lower production in Andhra Pradesh could result into uncomfortably high prices during August to September.

The figure 3 depicts the potato price seasonality. Prices normally starts rising from June onward and are firm till October. Prices start coming down from November as fresh crop from Punjab starts coming in markets and in few regions, stock of rabi crop is still available in cold storages. After Punjab, fresh crop from Uttar Pradesh followed by West Bengal, Bihar and Gujarat starts coming into the market. Fresh crop is available in the market till May and after that cold store, potato is consumed. Smaller quantity of fresh potato from the hilly states of Himachal Pradesh and Uttarakhand comes to the market during June to October but their prices are high compared to the cold store potato.

Price Volatility of TOP Crops

Price volatility in this paper is concerned with the monthly variability of the retail prices of Tomato, Onion and Potato around its central value i.e. the tendency for retail crop price to vary from its mean value of 5 years monthly prices. The historical volatility is observed on the past prices. It indicates how volatile a price has been in the past. In this paper, we are interested in measuring only the realised volatility based on past 3 years' monthly price movement of TOP crops.

Figure 3: All India Price Seasonality of Potato



Source: agmarknet.gov.in

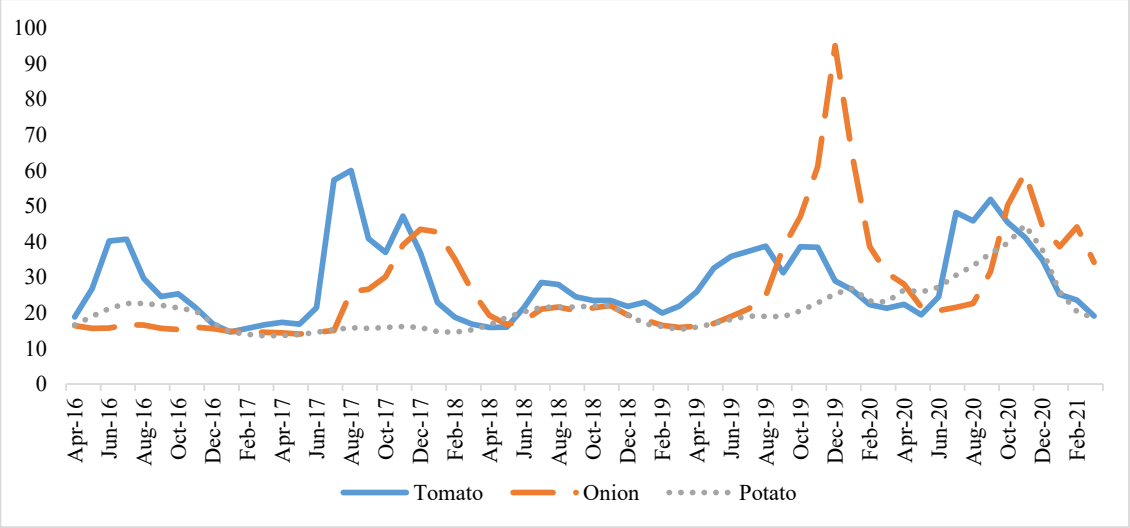
Price volatility is presented in terms of the annualised standard deviation of percentage price changes. We have focused on the standard deviation of prices, which expresses the standard deviation as a percentage of the sample mean.

Finally, the question is whether to calculate the volatility on nominal or real prices. However, in the case of real prices, it means that we have to deflate a series and this introduces another uncertainty in the measure of volatility. There is no consensus on the best deflator to use and due to data constrained decided to work on nominal price data in this study.

Figure 4 shows monthly retail price movement of TOP crops in last 5 years. It may be observed from the figure that it is very much visible that volatility in onion price is comparatively more than that of tomato and potato. However, tomato prices have seen sharp increase in prices in July-August 2017 and price rise in the same months in 2019 and 2020. Rise in prices of tomato mainly transpired during the monsoon season as high rainfall in large producing areas affect the crop production.

Potato is the least volatile among the TOP crops mainly because it has higher processing-to-production share (7%). On the other hand, onion has 3 per cent and tomato has 1 per cent processing to production share (Gulati et.al., 2019). Storage facilities for potatoes are comparatively more than onion. Usually, potato crop has witnessed increase in price volatility between November to January as prices go up in the month of October-November and come down in December-January as new crops arrived into the market. However, spike is more in year 2021 as price shot-up sharply during October-November as market arrival was lower for this year due to nation-wide induced lockdown and

Figure 4: Monthly Average Retail Prices at All India Level



Source: Department of Consumer Affairs, GoI.

prices fell drastically after harvesting of new crops in December-January. Table 7 shows the availability of storage infrastructure for potato in the major potato producing states.

Unlike potato and onion, tomato is also very perishable commodity and it has immediate effect of seasonality and production of crops. Price volatility index of tomato suggests that prices have changed up to 100 per cent in June-July 2017 and June-July 2020. Apart from that, prices of tomatoes change bit more frequently than potato. As data suggests that spike in tomato prices is due to lower supply from major tomato producing states like Maharashtra and Karnataka owing to heavy rainfall.

Price volatility of the onion is the highest among the TOP crops. Main factor behind the volatility in onion price is hoarding and lack of storage facilities in major producing states. Storage capacity for onion is much lesser than the potato in major producing states, like Uttar Pradesh (largest producer of potato) has 154 lakh tonnes storage capacity of potato while Maharashtra (largest producer of onion) has just 47 lakh tonnes storage of onion (Table 8). Low storage reduces the buffer, which causes jump in price during slack production year.

Another important reason of price volatility in onion is the production cycle. Onion is produced during (a) Rabi season-which is produced between March to May. It is mainly produced in Maharashtra and Madhya Pradesh. (ii) Kharif season-which is produced between September to November and

Table 7
Storage Capacity of Potato in Major Producing States

(In Lakh MT)

State	2018-19			2016-17			2017-18		
	Potato Storage Capacity	Potato Stored	Capacity Utilized (%)	Potato Storage Capacity	Potato Stored	Capacity Utilized (%)	Potato Storage Capacity	Potato Stored	Capacity Utilized (%)
Uttar Pradesh	154.55	129.82	84.00	142.18	111.1	78.14	126.41	124.62	98.58
West Bengal	70.62	57.91	82.00	70.62	65.31	92.48	69.81	65.76	94.19
Bihar	11.85	8.03	67.78	11.85	8.66	73.10	15.27	12.14	79.53
Punjab	19.66	14.4	73.27	19.66	18.87	96.00	19.5	19.36	99.27
Gujarat	28.75	25.7	89.38	28.75	22.18	77.17	28.5	25.28	88.12
Total-above states	285.43	235.86	82.63	273.06	226.12	83	259.49	247.16	95

Source: State Horticulture Department, Agriwatch Research.

Table 8
Storage Capacity of Onion in Maharashtra and Madhya Pradesh

(In lakh tonnes)

State	2018	2017	2016
Maharashtra	46.70	44.15	36.10
Madhya Pradesh	10.86	11.04	16.51

Source: State Horticulture Department, Agriwatch Research.

(iii) late Kharif season which arrives from mid-December until late February. The contribution of the onion production for these seasons is roughly 60 per cent, 20 per cent and 20 per cent, respectively of the total production. The uncertainty arises whenever there is negative uncertainty regarding Kharif crops (i.e. damage or delay in arrivals). If there is significant damage to the Kharif crop due to uncertain monsoon, it increases the burden of supply on the stored Rabi crop. Production of onion in Rabi season or late Kharif season crop are comparatively more manageable.

Trends in Prices of TOP Crops during 2020-21:

Potato price inflation reached a peak of 107 per cent in November 2020. Higher imports and fresh arrivals of early rabi production in the market led to a sharp easing in prices during December 2020-February 2021, with a deflation of (-) 21.3 per cent in February 2021. Inflation in onion prices, which was in negative territory during August-September 2020, witnessed substantial price pressures during September-November 2020 as excess rainfall in major producing regions of Madhya Pradesh, Gujarat, Karnataka and Maharashtra damaged the kharif crop and affected late kharif production, resulting in lower market arrivals. To contain the escalation in prices, the Government imposed an export ban on onions in September 2020 (removed in January 2021), increased imports, released buffer stocks and imposed stock holding limits on wholesalers and retailers under the Essential Commodities Act. These steps, along with fresh arrivals, led to onion prices moving into deflation during November 2020-January 2021. Onion prices picked up again in February 2021, however, due to drop in arrivals on account of unseasonal rainfall in January 2021 in Maharashtra. In the case of the third key vegetable, i.e., tomatoes, low arrivals from the key producing regions in Karnataka and Maharashtra on the back of excess rainfall pushed inflation to a peak of 54.5 per cent in September 2020. Thereafter, with an increase in fresh arrivals, prices eased beginning October 2020.

Overcoming the Marketing Challenges for Horticulture Crops: Recent Government Initiatives

Operation Greens

Government of India announced 'Operation Green' in the year 2018-19 on the lines of operation flood (AMUL Model) under Ministry of Food Processing Industries (MoFPI) with an outlay of Rs.500 crore and the aim of strengthening the TOP production clusters and their FPO, Agri logistic, processing facilities and professional management. The three major objective of the scheme were (i) containing price volatility, (ii) reducing post-harvest losses by setting up the essential farm gate infrastructure like warehouses, cold storages which better link the consumption centres and FPOs, and (iii) building efficient value chains which increase the food processing capacities of TOP crops and help the farmers get the larger share of income from the consumers spending.

Strategies for Achieving the Laid Down Objectives:

The operation is implementing two-pronged strategy of price stabilisation measures (for short term) and integrated value chain development projects (for long term).

(I) Short Term Price Stabilisation Measures

- NAFED is the Nodal Agency to implement price stabilisation measures.
- MoFPI is providing 50 per cent of the subsidy on the following two components:

i. Transportation of TOP Crops from production to storage

ii. Hiring of appropriate storage facilities for TOP Crops

(II) Long Term Integrated Value Chain Development Projects

i. Formation and Capacity Building of FPOs

ii. Quality Production

iii. Post-harvest processing facilities - At Farm Level

iv. Post-harvest processing facilities - At Main Processing Site

v. Agri-Logistics

vi. Marketing/Consumption Points

In June 2020, MoFPI extended the Operation Green from Tomato, Onion and Potato (TOP) crops to all fruits and vegetables (Total). The scheme was extended for a period of six months as part of Aatmanirbhar Bharat Abhiyan as per the budget of 2021 it will be further extended. The intervention was aimed at protecting the interest of fruit and vegetable farmers and prevent them from making distress sales due to lockdown. Operation Greens Scheme from TOP to TOTAL provides 50 per cent subsidy on transport and storage of notified fruits and vegetables if prices of such fruits or vegetables are below the trigger price. The 50 per cent

transportation subsidy is available for air transportation for 41 notified fruits and vegetables from North-Eastern and Himalayan States to any place in India. The transportation subsidy has been extended for Kisan Rail Scheme in December 2020. Any person, including farmers can transport any notified fruits and vegetable crops through Kisan Rails. Railways would charge only 50 per cent of freight charges on these fruits and vegetables. MoFPI will provide remaining 50 per cent of the freight charges as subsidy to the Indian Railways.

PM Kisan SAMPADA Yojna:

PM Kisan SAMPADA Yojna is a central sector scheme with a corpus of Rs.6000 crore under MoFPI. It is a comprehensive package which will result in creation of modern infrastructure with efficient supply chain management from farm gate to retail outlet.

The following schemes are being implemented under PM Kisan SAMPADA Yojana:

- Mega Food Parks
- Integrated Cold Chain and Value Addition Infrastructure
- Creation/ Expansion of Food Processing/ Preservation Capacities (Unit Scheme)
- Infrastructure for Agro-processing Clusters
- Creation of Backward and Forward Linkages
- Food Safety and Quality Assurance Infrastructure
- Human Resources and Institutions

The scheme addresses the issue of underdeveloped supply and value chains and aid in developing supply chains with effective forward and backward linkages. The grave problem of postharvest losses will be tackled by integrated cold chains and value addition infrastructure. The scheme will provide huge impetus to employment generation especially in rural areas. The farmers can have better bargaining powers and receive higher share of price to the consumers.

PM Kisan SAMPADA Yojana is expected to leverage investment of Rs.31400 crore for handling of 334 lakh MT agro-produce valued at Rs.104125 crore, benefiting 20 lakh farmers and generating 530500 direct/indirect employment in the country by the year 2019-20.

Agriculture Infrastructure Fund (AIF):

A Rs. one lakh crore Agriculture Infrastructure Fund for creation of farm-gate infrastructure for farmers has been operationalised by the government. This scheme will be operational from the year 2020-21 to 2029-30. The scheme provides for medium to long term debt financing facility for investment in viable projects for post-harvest management infrastructure and community farming assets. Under the scheme, Rs. 1 lakh crore will be provided by banks and

financial institutions as loans to primary agricultural credit societies (PACS), marketing cooperative societies, farmer producers organizations (FPOs), Self Help Group (SHG), farmers, joint liability groups (JLG), multipurpose cooperative societies, agri-entrepreneurs, start-ups and central/ state agency or local body sponsored public private partnership project, etc. All loans under this financing facility will have interest subvention of 3 per cent per annum up to a limit of Rs.2 crore. This subvention will be available for a maximum period of 7 years. Further, credit guarantee coverage will be available for eligible borrowers from this financing facility under Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE) scheme for a loan up to Rs.2 crore. The Agriculture Infrastructure Fund will go a long way in creating the requisite post-harvest infrastructure at the farm gate level and hence go a long way in enhancing bargaining power of the farmers.

CONCLUSION AND POLICY SUGGESTIONS:

Horticulture has been recognized as one of the rapidly growing and evolving sectors having the potential to lead us to our goal of doubling farmer's income by 2022. It has the potential to generate large number of employment opportunities. Its key role is to provide raw materials for various industries and is highly profitable owing to higher productivity compared to the food grains and its high export value helps in earning voluminous foreign exchange. The increase in horticulture production has brought in light the lacunae in the market infrastructure concerning it, more so with the ongoing fight with COVID-19 pandemic and the roadblocks that are being faced while tackling its effects on the economy. Better storage facilities, organized supply chains, regulated markets and better linkages have not accompanied the increased production between processing and organized retailing. It has resulted in distress sale or even disposal by farmers during a bumper production and high price volatility during shortages. Better storage facilities and focus on post-harvest management will reduce price volatility among TOP crops. This will not only reduce price seasonality and volatility in TOP crops but also improve profitability on crops resulting in better price realisation for the farmers.

It is imperative that government interventions are sought in creating the necessary infrastructure. The government schemes like Operation Green and PM Kisan SAMPADA Yojana are a step towards achieving the goal of developing the horticulture sector especially TOP crops and providing the farmers the means to handle their crops. With proper implementation, the number of intermediaries between the production and consumption

centres can be reduced. Value chains can be developed by increase in food processing industries. Forward and backward linkages thus developed will lead to better price realisation for the farmers and bring us closer to our goal of Doubling Farmers' Income.

REFERENCES:

Agriwatch (2016), Monthly Potato Report, May 2016, Agriwatch, New Delhi.

Agriwatch (2016), Weekly Onion Report, Agriwatch, New Delhi.

Gulati Ashok, and Wardhan, Harsh (2019), "Govt Needs to Find Sustainable Solution for Price Stabilisation of Tomatoes-Onions-Potatoes", 14 October, 20219, Indian Express, New Delhi.

CIPHET (2015), Assessment of Quantitative Harvest and Post-Harvest Losses of Major Crops/ Commodities in India, New Delhi.

Government of India (2021), Economic Survey 2020-21, Ministry of Finance, Government of India, New Delhi.

- (2021 a), Union Budget 2020-21, Ministry of Finance, Government of India, New Delhi.

- (2021 b), First Advance Estimates of Production of Foodgrains 2020-21, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture & Farmer Welfare, New Delhi.

Jha, Girish K, A Suresh, Bhoopesh Punera and P Supriya (2018), Growth of Horticulture Sector in India: Trends and Progress, *Indian Journal of Agricultural Sciences, Vol.* 89, No.2, pp 314-21.

Kissell, Robert and Glantz, Morton (2014), Multi-Asset Risk Modeling, Science Direct.

Reserve Bank of India (2021), Annual Report of RBI 2019-20, RBI, Mumbai.

- (2021 a), Monthly Bulletin, February 2021, RBI, Mumbai.

- (2021 b), Monthly Bulletin, March 2021, RBI, Mumbai.

Ruchira Boss and Mamata Pradhan (2020), Post-harvest Management and Farm Outcomes Storage Facilities Matter, *Economic and Political Weekly*, Vol. 55, Issue No. 16, pp 24-27.