



**Research Article**

## **PATTERN OF VEGETABLE CONSUMPTION IN INDIA- TOMATO ONION AND POTATO (TOP) SYNDROME**

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### **ABSTRACT**

Vegetables and fruits plays a crucial role in providing a diversified micronutrients rich diet essential to build strong immune system to fight against both communicable and non-communicable diseases. National sample survey, 68th round report provides information on monthly consumer expenditure on 12 fractile classes for rural and urban areas at all India level. The study focuses on Tomato, Onion and Potato (TOP) crops as these three crops have become very sensitive from the perspective of Indian consumers. The study attempts to examine, pattern of expenditure on common vegetables in relation to total food expenditure across different fractile classes, examine the importance of TOP vegetables across different fractile classes and analyse the policy implications. Analysis reveal that vegetables are the most important component of food consumption basket in both rural and urban areas irrespective of income classes. It is noted that the urban areas consumes nearly one-third more vegetables compared to rural India. Nearly fifty percent of the expenditure are incurred on TOP vegetables in all the twelve fractile groups in both rural and urban areas. The projects under operation green for TOP crops are yet to take off. There is an urgent need to hasten up the implementing processes so as to ensure that these schemes reach out both farmers' and consumers. It is essential that FPOs have to play key role in establishing proper backward and forward linkage for quick and rapid action. More investment have to flow towards R&D to evolve varieties that are suitable for processing and value addition. There is need to reverse this trend in the long run from TOP vegetables to other vegetables which have nutritional advantage compared to TOP vegetables. There is also dare need to put in place an accurate forecasting mechanism at grassroots especially to estimate the extent area being brought under TOP crops to prevent glut and scarcity conditions.

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### **INTRODUCTION**

The year 2021 has been declared as the International Year of Fruits and Vegetables (IYFV) by FAO of United Nations. It is needless to mention the importance of intake of vegetables and fruits in our daily food intake as it plays a crucial role in providing a diversified micronutrients rich diet essential to build strong immune system to fight against both communicable and non-communicable diseases especially when world was under the grip of COVID. Of late, vegetables is one of the important component of food basket both for the poor and rich households in both rural and urban areas. Prices of vegetables are highly volatile which is cause of concern for both consumers and as well as producers. World Health Organisation (WHO) has recommended a daily intake of at least 400 grams of fruits and vegetables excluding potatoes and other starchy tubers. The National nutritional guidelines recommends average daily consumption of 300 grams of

vegetables and 100 grams of fruit. As per the recommended Dietary Allowance (RDA), vegetables, fruit, green leafy vegetables, tubers should form the plate of recommended food per day in order to derive specified 2000 Kcal from Indian diet. India is the second largest producer of fruits and vegetables in the World. During 2019-20 India produced 100.4 million tonnes fruits and 191.7 million tonnes of vegetables. During 2017-18 the per capita availability of vegetables in India was 393.76 grams/ day while the per capita availability of fruits was around 207.9 grams/day. India has almost reached the requirement prescribed by WHO in respect of vegetables.

The National Sample Survey Office (NSSO) conducts nationwide household consumer expenditure survey at regular intervals. The report brought out by NSSO are effectively utilised by policy makers and academia to assess the overall social and economic status of rural and urban households

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across the country. The data generated by NSSO has been effectively utilized to derive poverty line and evolve several social security measures in support of vulnerable section of the society. NSSO (2014) has brought out a report on household consumption of various goods and services in India, 2011-12 as part of 68<sup>th</sup> round. The report has extensively documented monthly per capita quantity and value of consumption and incidence of consumption on food, non-food across states and as well for all India both for rural and urban areas.

During 2018 Government of India, Ministry of Food Processing Industries (MoFPI) launched operation green scheme in order to stabilize the supply of Tomato, Onion and Potato (TOP) crops and control its price volatility (<https://pib.gov.in>). The major objective of the scheme was to strengthen TOP production clusters and their FPOs. Ensure price stabilisation through proper planning of TOP crops, reduce post-harvest losses, increase food processing capacities, and set up market intelligence network. The scheme had an outlay of Rs 500 crores. During June 2020, MoFPI extended the Operation Greens scheme from Tomato, Onion and Potato (TOP) to all fruits & vegetables (TOTAL) for a period of six months on pilot basis as part of Aatmanirbhar Bharat Abhiyan. The scheme address the issue of glut during the harvest time and price spikes during the off-season. Why TOP has become very sensitive from the perspective of Indian consumers. In order to address these issues, the present study attempts to focus on the pattern of vegetable consumption in India using NSSO 68<sup>th</sup> round data. The specific objectives of the study are;

**Objectives**

1. Examine the pattern of expenditure on common vegetables in relation to total food expenditure across different fractile classes.
2. Examine the importance of TOP vegetables across different fractile classes.
3. Analyse the policy implications based on the findings.

**MATERIAL AND METHODS**

National sample survey, 68th round report provides information on monthly consumer expenditure on 12 fractile classes for rural and urban areas at all India level. As per the definition, for any fraction “f” between 0 and 1, the MPCE level such that 100f% of population lies below it is called f<sup>th</sup> fractile of MPCE distribution. Accordingly estimates of fractile classes provided in 68th NSSO report are, 0-5%, 5-10%, 10-20%, 20-30%, 30-40%, .....70-80%, 80-90%, 90-95% and 95-100%. Data pertaining to monthly per capita quantity (in kg) and value of consumption (in Rs) for seventeen vegetables for rural and urban areas across 12 fractile classes are collated from the 68<sup>th</sup> round NSSO report. Vegetables covered are, potato, onion, tomato, brinjal, radish, carrot, Palak/other, green chillies, lady’s finger, Parwal/patal/kundru, cauliflower, cabbage, gourd pumpkin, peas, beans/ barbati, lemon(no), and other vegetables. Simple tabular analysis is used for analysing the data. Rank correlation coefficient is calculated to examine the order of preference across different vegetables between bottoms most and top most fractile groups.

**RESULTS AND DISCUSSION**

We shall begin our analysis by glancing at the value of monthly consumption on common vegetables as proportion of

total food expenditure across fractile classes for rural and urban India. The results are presented in Table-1. It may be observed from the Table-1 that the extent of expenditure incurred on vegetables increase as one move along the fractile groups both in rural and urban India. The expenditure incurred on vegetables by the top most fractile group namely, 12<sup>th</sup> fractile group is Rs. 162.31 in rural areas and Rs. 197.38 in urban areas which is nearly three times the expenditure incurred on vegetables compared to bottom most fractile group, that is, first fractile group. The first fractile group spend only Rs. 52.32 in rural areas and Rs. 62.07 in urban areas. On the other hand, if one were to consider the proportion of expenditure spent on common vegetable in respect to total food expenditure, there is an inverse relationship across fractile classes. In rural areas, bottom most fractile group spend nearly 17 percent of food expenditure on common vegetables. While it is around 9 percent in respect of top most fractile class. Similar pattern is observed even in respect of urban areas. The bottom most fractile group in urban areas spend 15 percent of food expenditure on common vegetables, while it is only 7 percent in case of top most fractile group. There is gradual decline in proportion of expenditure incurred on common vegetables to food expenditure across fractile classes in both rural and urban areas. Thus vegetables are the most important component of food consumption basket in both rural and urban areas irrespective of income classes.

**Table 1** Share of common vegetables in total food consumption across fractile groups- Rural and Urban –India

Fractile Classes	RURAL			URBAN		
	Monthly expenditure on common vegetables (in Rs)	Monthly expenditure on food items. (in Rs)	Proportion of monthly expenditure on common vegetable to total food expenditure (in percent)	Monthly expenditure on common vegetables (in Rs)	Monthly expenditure on food items. (in Rs)	Proportion of monthly expenditure on common vegetable to total food expenditure (In Per cent)
1	52.32	315.84	16.57	62.07	414.73	14.97
2	63.77	400.51	15.92	73.75	532.4	13.85
3	71.11	472.35	15.05	81.78	628.17	13.02
4	78.62	535.26	14.69	93.54	741.07	12.62
5	82.54	599.07	13.78	103.41	855.47	12.09
6	88.49	659.1	13.43	113.09	948.34	11.93
7	92.91	721.78	12.87	126.35	1057.81	11.94
8	99.74	794.89	12.55	136.77	1183.05	11.56
9	108.82	891.33	12.21	146.7	1342.64	10.93
10	118.91	1039.54	11.44	159.44	1576.6	10.11
11	131.74	1216.55	10.83	178.77	1945.69	9.19
12	162.31	1770.35	9.17	197.38	2859.12	6.90
All	94.62	756.49	12.51	121.7	1120.88	10.86

Source: 68<sup>th</sup> NSSO round report.

Having observed that vegetables are the important component of food basket, we shall try to understand the pattern of expenditure on individual vegetables in both rural and urban areas. The consumption of common vegetables both in terms of quantity and value for rural and urban areas are presented in Table-2. As mentioned earlier, there are seventeen vegetables items on which data has been reported in 68<sup>th</sup> round of NSSO report. The quantity of vegetables consumed are expressed in per capita consumption in 30 days in kg, except for the item lemon, which has been expressed in nos. For all the items value has been expressed in terms of rupees. It may be noted from table-2 that the per-capita monthly consumption of vegetables is 6.76 kg in rural areas, while it is 9.22 kg in respect of urban areas. The urban areas consumes nearly one-third more vegetables compared to rural India. On the other hand, when the value of consumption on common vegetables is expressed as percentage to expenditure on food items, rural

areas spend 12.51 percent of their food expenditure on vegetables, while it is 10.86 percent in respect of urban areas. Similarly, when we consider overall expenditure both on food and non-food items, rural areas spend 6.61 percent of their overall expenditure on vegetables while it is only 4.62 per cent in case of urban areas. Of course, difference in expenditure between rural and urban areas may be attributed to the fact that urban areas relatively spend more on food and as well as on both food and non-food items compared rural areas. In urban areas they spend 48 per cent more on food items compared to rural areas and 84 percent more on overall expenditure (food +non-food) compared rural areas.

**Table 2** Consumption of common vegetables –All India

Vegetables	Per capita consumption in 30 days				Value expressed in percentage to value of all vegetables	
	Quantity (kg)		Value(Rs)		Rural	Urban
	Rural	Urban	Rural	Urban		
Potato	1.965	1.612	18.80	17.41	19.88	14.31
Onion	0.842	0.951	11.39	13.66	12.04	11.23
Tomato	0.586	0.806	9.24	13.90	9.77	11.42
Brinjal	0.428	0.358	6.73	6.96	7.12	5.72
Radish	0.147	0.140	1.38	1.73	1.46	1.42
Carrot	0.078	0.153	1.34	3.26	1.42	2.68
Palak/other	0.590	0.528	7.65	9.74	8.09	8.00
Green Chillies	0.152	0.166	4.94	5.69	5.22	4.68
Lady's finger	0.209	0.281	4.32	7.46	4.57	6.13
Parwal/patal, kundru	0.105	0.106	2.14	2.65	2.26	2.18
cauliflower	0.284	0.326	3.95	6.50	4.18	5.34
Cabbage	0.227	0.271	2.88	4.61	3.05	3.79
Gourd, pumpkin	0.359	0.281	4.37	4.44	4.62	3.65
Peas	0.096	0.150	1.65	3.40	1.74	2.79
Beans /barbati	0.102	0.139	2.35	3.99	2.48	3.28
Lemon(no)	1.211	2.117	1.88	3.72	1.99	3.06
Other vegetables	0.590	0.574	9.57	12.56	10.12	10.32
All vegetables	6.76*	9.22*	94.62	121.70	100.00	100.00
Consumption on Food items	-	756.49	-	1120.88	-	-
Consumption on Food (F)+Non-Food(NF) items	-	1429.96	-	2629.65	-	-
Value of consumption on vegetables as percentage to food items	-	-	-	-	12.5	10.86
Value of consumption on vegetables as percentage to (F+NF)	-	-	-	-	6.61	4.62
Consumption on (Potato+Onion+Tomato) as percentage to all vegetables	-	-	-	-	41.69	36.96

Source: 68<sup>th</sup> NSSO round report. \* Lemon has not been included under all vegetables in respect of quantity.

Interestingly when we analyse consumption pattern of each individual vegetables, it may be noted that in rural areas, three vegetables namely, potato, onion and tomato account for 3.933 kg out of total monthly consumption of vegetable of 6.76 kg (table-2). This accounts for 50 percent of total quantity of vegetable consumed in rural areas. On the other hand when these three vegetable though account 3.369 kg (table-2) in urban areas, relatively less compared to rural areas, it accounts for 36.5 percent of total quantity of vegetables consumed in urban areas. The other two vegetables which are relatively consumed in higher quantity both in rural and urban areas are brinjal and leafy vegetable like palak and others.

It is hypothesised that the pattern of vegetable consumption vary across fractile groups. In order to put this hypothesis to test, we have considered consumption of common vegetables among bottom most fractile group (Fractile-1) and top most fractile group (Fractile-12). The results for rural and urban areas are presented in Table-3 and Table-4 respectively.

**Table 3** Consumption of Common Vegetables among bottom and top fractile classes-Rural- India

Vegetables	Per capita consumption in 30 days				Value expressed in percentage to value of all vegetables	
	Fractile-1		Fractile-12		Fractile-1	Fractile-12
	Qty(kg)	Value(Rs)	Qty(kg)	Value(Rs)		
Potato	1.798	15.54	1.807	20.38	29.70	12.56
Onion	0.476	6.12	1.408	20.52	11.70	12.64
Tomato	0.329	4.3	1.073	18.91	8.22	11.65
Brinjal	0.316	4.04	0.554	9.89	7.72	6.09
Radish	0.092	0.65	0.253	2.67	1.24	1.65
Carrot	0.016	0.16	0.272	5.31	0.31	3.27
Palak/other	0.460	4.46	0.742	12.45	8.52	7.67
Green Chillies	0.077	2.6	0.246	7.49	4.97	4.61
Lady's finger	0.087	1.41	0.374	8.7	2.69	5.36
Parwal/patal, kundru	0.047	0.83	0.129	2.89	1.59	1.78
cauliflower	0.185	1.88	0.411	7.61	3.59	4.69
Cabbage	0.123	1.18	0.299	5.15	2.26	3.17
Gourd, pumpkin	0.241	2.41	0.487	7.5	4.61	4.62
Peas	0.036	0.51	0.197	4.37	0.97	2.69
Beans /barbati	0.062	0.95	0.215	5.81	1.82	3.58
Lemon(no)	0.176	0.26	3.061	5.01	0.50	3.09
Other vegetables	0.402	4.97	0.888	17.61	9.50	10.85
All vegetables	4.747*	52.32	9.355*	162.31	100.00	100.00
Consumption on Food items	-	315.84	-	1770.35	-	-
Consumption on Food (F)+Non-Food(NF) items	-	521.44	-	4481.18	-	-
Value of consumption on vegetables as percentage to food items	-	-	-	-	16.56	9.16
Value of consumption on vegetables as percentage to (F+NF)	-	-	-	-	10.03	3.6
Rank correlation between quantity of consumption between F-1 and F-12 classes	-	-	-	-	0.99	-
Rank correlation between value of consumption between F-1 and F-12 classes	-	-	-	-	0.98	-

Source: 68<sup>th</sup> NSSO round report. \* Lemon has not been included under all vegetables in respect of quantity.

It may be noted that as per 68<sup>th</sup> NSSO report the first fractile class is referred to bottom 5% (0-5%) of population and 12<sup>th</sup> fractile class is referred to top 5% five percent (95-100%) of population. In regard to rural areas, top most fractile group consume twice the quantity of vegetables compared to bottom most fractile group. In terms value, top most fractile group spend as much as thrice the amount when compared to bottom most fractile group. Value of consumption of common vegetables over the value of consumption of food items was of the order of 16.56 % and 9.16% for bottom and top most fractile groups respectively. When we calculated the proportion considering value of vegetable consumption over both food and non-food items, it worked out to be 10.03% and 3.6% for bottom and top most fractile groups.

When we look at the quantity and value of consumption for each individual vegetables, no doubt, there has been considerable variation between bottom and top fractile groups. But our interest was to know whether there is any change or preferences in the pattern of vegetable consumption between top and bottom fractile groups. In order to address this issue, we have calculated rank correlation between the consumption pattern of bottom and top fractile groups. Interestingly we have obtained very high rank correlation of the order of 0.99 for quantity and 0.98 for value of vegetables. This indicates that the order of preferences for various vegetables are similar for both bottom and top fractile groups.

Similar exercise was carried out for urban India. The results are presented in Table-4. The results are in line with what is being observed for rural India. In urban areas, top most fractile group consume 183 percent more quantity of vegetables

compared to bottom most fractile group. In terms value, top most fractile group spend as much as thrice the amount when compared to bottom most fractile group.

investigate the type of preferences for different vegetables shown by various fractile classes among rural and urban India.

**Table 4** Consumption of Common Vegetables among bottom and top fractile classes –Urban – India

Vegetables	Per capita consumption in 30 days				Value expressed in percentage to value of all vegetables	
	Fractile-1		Fractile-12		Fractile-1	Fractile-12
	Qty(kg)	Value(Rs)	Qty(kg)	Value(Rs)		
Potato	1.751	15.7	1.749	21.27	25.29	10.78
Onion	0.58	7.63	1.272	20.17	12.29	10.22
Tomato	0.415	6.07	1.156	22.25	9.78	11.27
Brinjal	0.289	4.27	0.41	9.31	6.88	4.72
Radish	0.078	0.78	0.221	3.22	1.26	1.63
Carrot	0.03	0.42	0.311	7.64	0.68	3.87
Palak/other	0.358	4.21	0.657	15.29	6.78	7.75
Green Chillies	0.097	3.25	0.194	7.51	5.24	3.80
Lady's finger	0.114	2.16	0.438	13.83	3.48	7.01
Parwal/patal, kundru	0.082	1.51	0.153	4.42	2.43	2.24
cauliflower	0.216	2.63	0.493	12.36	4.24	6.26
Cabbage	0.178	2.01	0.354	7.2	3.24	3.65
Gourd, pumpkin	0.282	3.16	0.37	7.14	5.09	3.62
Peas	0.082	1.11	0.254	8.25	1.79	4.18
Beans /barbati	0.052	1.01	0.215	7.28	1.63	3.69
Lemon(no)	0.63	0.95	4.123	8.76	1.53	4.44
Other vegetables	0.351	5.18	0.835	21.42	8.35	10.85
All vegetables	4.955*	62.07	9.082*	197.38	100.00	100.00
Consumption on Food items	-	414.73	-	2859.12	-	-
Consumption on Food (F)+Non-Food(NF) items	-	700.50	-	10281.84	-	-
Value of consumption on vegetables as percentage to food items	-	-	-	-	14.96	6.90
Value of consumption on vegetables as percentage to (F+NF)	-	-	-	-	8.86	1.92
Rank correlation between quantity of consumption between F-1 and F-12 classes					0.89	
Rank correlation between value of consumption between F-1 and F-12 classes					0.75	

Source: 68<sup>th</sup> NSSO round report. \* Lemon has not been included under all vegetables in respect of quantity.

**Table 5** Share of Potato, Onion and Tomato in consumption of common vegetables across fractile groups- Rural and Urban – India

Fractile Classes	RURAL		URBAN	
	Extent of Potato + onion+ tomato in total quantity of vegetable consumed. (in percent)	Extent of Potato + onion and tomato in total value of vegetable consumed. (in percent)	Extent of Potato + onion+ tomato in total quantity of vegetable consumed. (in percent)	Extent of Potato + onion and tomato in total value of vegetable consumed. (in percent)
1	54.83	49.87	55.42	48.10
2	53.32	47.66	54.73	46.27
3	54.07	47.51	53.20	43.74
4	52.01	45.29	51.50	41.57
5	51.39	44.49	50.06	39.83
6	50.56	44.60	50.58	40.12
7	47.75	41.87	48.64	37.87
8	48.87	40.69	48.46	36.99
9	48.83	40.94	46.95	36.45
10	47.77	39.85	45.70	34.24
11	47.40	39.52	45.19	34.11
12	45.84	38.02	45.99	33.77
All	50.19	42.52	47.43	38.12

Source: 68<sup>th</sup> NSSO round report. \* Lemon has not been included under all vegetables in respect of quantity and value.

The value of consumption of vegetables over the value of consumption of food items was of the order of 14.96% and 6.90% for bottom and top most fractile groups respectively. Considering both food and non-food items, it worked out to be 8.86 % and 1.92% for bottom and top most fractile groups. Even in respect of urban areas, we have obtained very high rank correlation of the order of 0.89 for quantity and 0.75 for value of vegetables. This indicates that, even in urban areas the order of preferences for various vegetables are similar for both bottom and top fractile groups. The result made us to further

**Tomato-Onion- Potato (TOP) Syndrome**

After having established the fact that there appears to be a similar pattern in consumption of common vegetables among the bottom and top fractile classes, though there has been a considerable variation in both the quantity and as well value of vegetables. This led us to examine to what extent the pattern of consumption is consistent among all the fractile classes. We have selected the top three vegetables, potato, onion and tomato to know the proportion of its consumption and value spent on these three vegetables across all the 12 fractile classes. The results are presented in Table-5.

It may be noted from the Table-5 that across all the fractile classes three vegetables namely, potato, onion and tomato account for nearly fifty per cent of the total quantity of vegetables consumed both in respect of rural and urban areas. Proportion is little more than fifty percent until sixth fractile class. While the consumption of these three vegetables are more than fifty percent in first three bottom fractile classes. Thus potato, onion and tomato may be considered as essential vegetables for all the twelve fractile classes. Even in value terms the proportion of expenditure on these three vegetables are considerably high in both rural and urban areas. The bottom six fractile classes in rural area spend nearly 45 percent of the total value of expenditure incurred on vegetables on these three vegetables. Compared rural areas though the proportion of expenditure on these three vegetables are relatively less in urban areas, still the major portion of expenditure is being spent on these three vegetables. The variation in prices of these three vegetables create big hue and cry in the market, as they find important place in consumer basket across all the income classes. Tomato, onion and potato popularly known as TOP vegetables are the three important vegetables produced and consumed in India. India is the second largest producer of all the three vegetables after china in the world. Out of 102 lakh hectares under vegetable in 2018-19, TOP accounts for 41 percent of total vegetable acreage. The price sensitivity of TOP vegetable crops has made Government of India to initiate Operation Green (OG) which include short and long term measures to stabilize prices and develop an integrated value chain. Ministry of Food Processing Industries (MoFPI) has extended the OG scheme from TOP to all fruits and vegetables from the year 2020 on a pilot basis for a period of six months as part of Aatmanirbhar Bharat Abhiyan. Ministry provides subsidy up to 50% of the cost on two components. First, transportation of eligible crops from surplus production cluster to consumption centre. Second, hiring of appropriate storage facilities for eligible crops for maximum period of three months.

## CONCLUSION

The NSSO 68<sup>th</sup> round reveal that the tomato, onion and potato (TOP) vegetables are the first three top vegetables among the vegetable list in all the fractile groups in both rural and urban areas. Nearly fifty percent of the expenditure are incurred on these three vegetables in all the twelve fractile groups in both rural and urban areas. There has been demand for TOP vegetables throughout the year. But, prices of tomato, onion and potato continue to be volatile. Export ban and stocking limit imposed on traders are the common short term strategies adopted by the government to control the prices of TOP vegetables. Efforts are being made to ensure that farmers get remunerative prices and consumers can get these vegetables at affordable prices. The Economic Survey 2021-2022 identifies two major reasons for variation in prices of perishable commodities. First reason being seasonality in production. Production of TOP vegetables vary considerably over different months of the year. Second reason being irregular shocks experienced by the crops such as uncertain weather conditions like floods and drought like situations during the growing period of crops. Presently all the three crops are traded at APMCs. The study has shown that farmer's share to be 32.1%, 29.1%, and 26.6% of consumer rupee for tomato, onion and potato crops respectively (Gulati Ashok and Wardhan, 2019). Processing of potato, onion and tomato is around seven

percent, three percent and processing of tomato is abysmally low at one percent.

The projects under operation green for TOP crops are yet to take off. As per the report by MoFPI, six projects with project cost of ₹363.30 Crore, with grant-in-aid of ₹136.82 Cr, targeting 31 FPOs in six production clusters have been approved; one each for tomato, onion and potato in Gujarat, two for onion in Maharashtra and one for tomato in Andhra Pradesh. There is an urgent need to hasten up the implementing processes so as to ensure that these schemes are operational for the benefit of both farmers' and consumers. The scheme is designed to siphon off the surplus production from identified production cluster to distant markets by way of providing transportation cost to enable both producer to realize remunerative prices for their produce and the same time consumer to get the produce at reasonable price. Besides the scheme also support to store the commodities at least for the period of three months by way meeting the cost of the storage. It is essential that FPOs have to play key role in establishing proper backward and forward linkage for quick and rapid action. Operation green also has long term perspective of assisting FPOs to go for creating necessary infrastructure facilities for scientific storage and processing. The FPOs can also tap the export potential of TOP vegetable crops by establishing robust value chain which is presently inadequate for horticulture crops (Ashok Gulati, *et al*).

It is essential to ensure stable price for TOP crops across the country. We need to identify the TOP production clusters and assess the seasonality of arrivals. There is an urgent need to link production clusters with major markets where these crops are absorbed fairly at a stable price that do not inflict any losses on cultivators. Establishment of national grid for at least major essential vegetable crops like TOP will go a long way in management of surpluses which benefits both producers and as well the consumers. The schemes like operation green and subsequent expansion of scheme to other fruits and vegetables have to be judiciously utilised for the benefit of farming community. FPOs can facilitate as aggregators in channelizing the produce from surplus to deficit regions and help to build a sound value chain on a long run. FPOs can also create storage facilities to hoard the produce and stagger the release of the produce as an effective way to control prices in the market. Thus private players have to play an important role along the value chain.

More investment have to flow towards R&D to evolve varieties that are suitable for processing and value addition especially to develop technologies for dehydrated potatoes. In order to prevent glut in the arrivals in the market it is most essential to scientifically forecast exact area sown under tomato, onion and potato crops, has this been a very weak link in the entire process of value chain. Since these crops are grown in a small plots its estimation and aggregation at state and national level appears to be tedious task. There should be a mechanism grounded at grassroots that would provide most accurate area being brought under TOP crops along with date of sowing. This task have to be undertaken by state department of horticulture. Such information will enable to scientifically forecast the arrivals and thereby prior arrangements can be made to prevent the glut or short supply of TOP vegetable crops. As we are aware that the TOP vegetables account for nearly fifty percent of expenditure incurred in all the fractile groups both in rural and urban areas, there is need to reverse

this trend in the long run as there are other vegetables which have nutritional advantage compared to TOP vegetables. Consumers should be made aware of the benefits in consuming especially leafy vegetables and also substitute vegetables that provide them more carbohydrates like potato that are available at much less cost.

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