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**RAPPORTEURS' REPORTS**

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**Rapporteur's Report on Triggering Agricultural Development through Horticultural Crops**

**Rapporteur: Sudha Mysore\***

India's agriculture development strategy over the years has shifted from enhancing cereal production triggered by green revolution, to increasing acreage under semi-arid and arid agriculture, watershed management to crop-diversification modules through the setting up of plantation boards, special mission on horticulture. In the process the focus has shifted from one of ensuring food security to one of creating exportable surpluses which could be traded in the global agricultural commodity market, this, while not compromising food security of the toiling millions below the poverty line through state supported public distribution system and subsidy towards input use.

This shift in focus appears to be commensurate with acceleration of agricultural growth, as is reflected in high growth of country's gross domestic product (GDP), especially during the mid-1990s (5.8 per cent during 1980-81 to 1989-90 to 6.8 per cent during 1993-94 to 1995-96), despite intermittent setbacks. However, achieving an ambitious target growth of 8 per cent for GDP and 4 per cent for agriculture in the coming plan period is a Herculean task given the slowing down of production growth rate of several commodities including that of cereals. In contrast, the horticultural crop sector has been registering a growth rate of over 4 per cent per annum, experiencing increasing domestic and export demand, demonstrating comparative advantage that could be converted into a competitive advantage thereby strengthening the shift in focus of diversification in favour of horticultural crops.

Horticulture comprising fruits, vegetables, flowers, medicinal and aromatic crops, plantation crops, spices, coconut and cashew with 15.71 million hectares and a production of 152.7 million tonnes, has emerged as a core sector in India over the last two decades. This sector contributes to about 24 to 28 per cent of agricultural GDP, provides employment for around 19 per cent of the country's agricultural work force. In addition to the emphasis as foreign exchange earner to the economy, these set of crops are also expected to provide the nation's nutritional requirements within the changing lifestyle of a growing economy, where in service sector is setting the trends of consumption. These set of crops with their sheer tenacity to adapt to diverse agro-climate, hold the potential not only to fit into crop diversification models, but provide the much needed farm level sustainability as well.

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\*Senior Scientist, Agricultural Economics, Indian Institute of Horticultural Research, Bangalore – 560 089 (Karnataka).

Despite India's unique comparative advantage in production of variety of horticulture crops (for local, national and international markets) its development is constrained by several factors from the production as well as market - related. Unorganised and inefficient marketing triggering high price spread, poor infrastructure and non transparent price discovery, high wastage due to poor logistics and the absence of cold chains; lack of market access, absence of innovative marketing arrangements and facilities for value addition to mitigate production and marketing risks, etc., are of significance, to name a few. While ensuring an inclusive growth strategy in agriculture, most of these areas are found to be under-investigated and under-invested requiring effective research support.

- (a) Farm level diversification with horticultural crop based farming systems which addresses the food security and income surplus at the household level.
  - Changing pattern of acreage and production growth of cereals vs. horticulture crops across the growing regions over the last few decades.
  - Pattern of crop diversification through horticultural crops across different farm size categories and the impact thereof on farm income and employment generation.
- (b) Issues around production arrangements and market intelligence which triggers production and reduce the producer's risk.
  - Assessment of post harvest losses and other marketing risks of horticultural crops in comparison to other field crops.
  - Assessment of the status of policy interventions to mitigate risk in different crops and their effectiveness across regions.
- (c) Efficiency and effectiveness of the marketing channels, their institutionalisation and re-organisation where the need be.
  - Contract farming as a risk averting strategy and the constraints there of in extending it across different crops and agro climatic regions.
  - Market access and means of linking farmers to markets with illustrative success stories and models.
- (d) Research in new product development to tap the emerging opportunity and changing consumer taste.
  - Processing and value addition as a means for enhancing profitability of horticultural crops.
  - Assessing the scope of income and employment generation through production of value added products in horticultural crops.

Keeping in view the growing significance of the horticulture sector, the Indian Society of Agricultural Economics, has rightly selected the topic, "Triggering Agriculture Development through Horticultural Crops" for discussion at the 68th annual conference. The topic attracted lot of attention and a total of 60 research papers covering different aspects including growth pattern, crop diversification, government initiatives, performance of different regions in horticultural crop production, profitability, marketing channels and price spread, post-harvest loss assessment, contract farming, agro processing and value addition, market linkages, price analysis, export performance, income and employment, demand etc., have been submitted.

A total of 54 papers have been selected for discussion at the conference. Though a number of papers were well researched and documented, only four could be selected for full length presentation due to space limitations. Based on the main thematic areas covered under these papers, they have been grouped into twelve topics relating to horticultural crops. Many papers covered more than one thematic area, but have been grouped based on the primary focus of the paper. The distribution of papers under different themes is presented below.

TABLE 1. THEMATIC DISTRIBUTION OF DISCUSSION PAPERS

Theme No. (1)	Theme area (2)	No. of papers (3)	Percentage to total* (4)
I	Growth & crop diversification	6	10.7
II	Horticulture development in different Regions	11	19.6
III	Demand for horticultural crops	3	5.4
IV	Horticulture development and small farm households	3	5.4
V	Horticultural crop Cultivation & profitability	6	12.5
VI	Assessment of Post harvest losses in horticultural crops	4	7.1
VII	Marketing practices and channels and efficiency	7	12.5
VIII	Alternate marketing arrangements including Contract farming	2	5.4
IX	Processing	5	8.9
X	Exports	4	7.1
XI	Income and employment generation due to horticultural crops	6	10.7
XII	Government initiatives	2	3.6
	Total Number of discussion papers	54	

\* Total does not add up to 100 as the some papers covered more than one theme area.

The salient features from these papers are summarised theme wise for arriving at pertinent discussion issues at the conference.

## I

## GROWTH AND CROP DIVERSIFICATION INVOLVING HORTICULTURE

Horticulture, comprising a wide variety of crops including fruits, vegetables, ornamental, medicinal, plantation crops and spices, has been the core sector contributing over 28 per cent of the country's agricultural GDP. Though there has

been a decline in the relative share of horticulture over the years, the sector continues to provide impetus for sustaining the country's agricultural growth. The need to achieve self-sufficiency in foodgrain production being the top priority, the horticultural crop sector did not receive its due, till the fourth plan period (1969-74). Having secured this objective, diversification towards crops other than cereals began from the early eighties, though not strictly in favour of horticultural crops. The trend in favour of horticultural crops started getting momentum during the early 1990s, which also coincided with the liberalisation of seed import policy adopted by the Government of India.

Ramesh Chand *et al.*, provide the direction for this discussion by bringing forward the decadal changes in area under different crop groups and the reigning supremacy of horticultural crops over the years. A closer examination of the changes in area under different crop groups from 1980-81 to 2005-06 clearly brings forth a perceptible shift in the cropping pattern away from cereals and pulses towards others including oilseeds and horticulture. With an increase in per cent share in area from 4 to 6.5 from 1980-81 to 2005-06, horticultural crops, especially fruits and vegetables benefited the most from this shift in cropping pattern. The increase in area from 1990 to 2004 has been estimated at 72,700 hectares for horticultural crops, of which fruits registered the highest increase followed by vegetables. The area under cereals, pulses and food grains declined considerably during this period (Ramesh Golait and N.C. Pradhan).

Agricultural growth has decelerated from 3.2 per cent (1980/81 to 1995/96) to 1.9 per cent during 2005-06, leading to an agrarian distress, while the economy on the whole maintained a growth rate of around 6 per cent. Within the agriculture sector, the high-value segment inclusive of horticultural crop group was expected to contribute more to the economy as also to the well being of small holders (Singh and Mathur; Joshi *et al.*, 2004).

Pratap S. BIRTHAL *et al.*, strengthen this argument by providing a decomposition of growth sources into different factors. Growth was primarily thought to be productivity linked as it led to around 62 per cent of the increased production during 1981-82 to 1995-96, hence, a technology-led one. However, the decomposition of growth into different factors brought forward the fact that crop diversification from lower value to high value crops, increased prices besides area expansion to be the other factors that contributed to 20, 12 and 6 per cent, respectively. Similar analysis of data for the period between 1995 and 2005 indicated that although technology remained an important source, its share declined to 45 per cent. Diversification to high value crops was the second largest contributor being 42 per cent. The contribution of different crop groups for this growth revealed the significance of horticultural crops and justified the increasing emphasis on this set of crops, as they contributed the highest to the total value of crop output (25.6 per cent) by 2004-05, their share in the overall growth of the agricultural sector has been the highest. Agricultural growth has declined and would have declined further had it not been for

the robust growth of fruits and vegetables (F&V) which in fact cushioned the decline in growth of agriculture to a large extent (Birthal *et al.*).

The total impact of increased area and productivity is reflected in the overall increase in production. A perusal of data on output growth rate of different crop groups across different periods revealed that output of fruits and vegetables, condiments and spices rose at much faster rate than that of other crop groups since 1970-71. Horticultural crop production registered an increase of 2.9 per cent per annum during 1970s, while that of all crop sectors at 1.8 per cent. This trend continued and received a further boost in the 1990s with a growth rate of F&V reaching 6 per cent and that of condiments and spices 5 per cent. The relative share of different crop groups to the total agricultural production during different periods also indicated an increasing share of fruits and vegetables and horticulture as a whole and declining shares of cereals and pulses (Chand *et al.*).

The high growth rate of horticulture witnessed during the 1990s could not be sustained due to the slowdown in growth of fruits and vegetables, which could be attributed largely to the changing weather patterns. Though specific crop groups like spices and fruits (during 1991-92 to 2005-06); brinjal, citrus, cashew (from 1995-96 to 2005-06) did show higher growth rates, it was marred by instability in area (Singh and Mathur), the reasons for which need a thorough discussion. Arvind Awashti further provides evidence to a weak or negative productivity coefficient in case of vegetables during this period in comparison to the positive coefficient for food grains, raising doubts on the strength of horticultural crop sector. However, Chand *et al.*, further strengthen the case of horticultural crops stating that, despite the slow down in growth rate, the share of fruits and vegetables in area increased from 2.8 to 4.9 per cent and their share in crop output increased from 15.95 to 25.61 per cent; share of cereals in area declined from 60.4 per cent to 52 per cent and in output from 37.2 per cent to 30.2 per cent.

## II

### CROP DIVERSIFICATION AND HORTICULTURE GROWTH ACROSS REGIONS

Diversification drive in favour of horticulture is chiefly due to economic factors since they are characterised not only by high productivity and higher returns but also by generating high employment and exports (Kaul, 1997). A closer examination of different regions or states in their drive towards crop diversification process from low value to high value crops, show that Maharashtra, Gujarat, Karnataka, Andhra Pradesh, Kerala, Tamil Nadu, Punjab, Haryana, West Bengal and Rajasthan take a lead (Chand *et al.*; Bimal Kumar Bera;). The crop diversification drive has resulted in increased value of horticultural products in comparison to agricultural products over time. According to Deepak Shah, the total value of horticultural products by 2003-04 stood at Rs. 1,47,024 crores, with fruit and vegetable products accounting for 90 per cent of the same. The rate of increase in the value of this sector has been increasing,

from 174 per cent (1970-71 to 1980-81) to 214 per cent (1980-81 to 1990-91) and 650 per cent by 2003-04.

Changes in the degree of agricultural diversification measured in terms of Herfindahl index for 1992-93 to 2005-06 indicated increased diversification index for horticultural crops over field crops. The projected share of fruits, vegetables and plantation crops and spices till 2012 showed increasing trend, while that of field crops a declining trend (Mahendra Singh and V.C. Mathur). Moloy Kanti Roy *et al.*, estimated Herfindahl index for Tripura from 1985-86 to 2005-06 and observed prominent crop diversification during the late nineties and early 2000. They attribute the sluggish index in the eighties to the slow growth in public investment on irrigation, research and development and rural infrastructure.

Maharashtra, Gujarat and Andhra Pradesh were among the states that showed maximum increase in area, production and yield of horticultural crops from 1991-92 to 2005-06 (Singh and Mathur; S.S. Kalamkar) Almost all states, except Punjab and Haryana showed increased share of cropped area towards fruit and vegetables during 1990-91 and 2005-06. Andhra Pradesh with an increased share of horticultural crops from 4 to 7.2 per cent leads followed closely by Maharashtra (2.3 to 5 per cent), Gujarat (1.8 to 3.5 per cent), Karnataka (2.3 to 4.3 per cent) and Tamil Nadu (5.4 per cent to 9.4 per cent). Bihar and Uttar Pradesh showed very slow diversification towards horticulture (Chand R. *et al.*, A.K. Giri)

R.K. Singh and N.P. Singh, analyse the status of horticulture in Uttar Pradesh and identify a series of issues such as post-harvest loss reduction, processing methods, product quality and the suitable analytical method for effective evaluation. Smita Sirohi and Rajni Jain report marginal diversification drive in Haryana from 1.55 per cent in 1990-91 to 4 per cent in 2003 on marginal holdings. The crop diversification is entirely from area expansion as yield has stagnated and suggests measures for improving adoption of technologies and package of practices. In sharp contrast, Latika Sharma and D.C. Pant observed positive and high growth rate of fruit productivity in comparison to negative growth for vegetables in Rajasthan from 1990-91 to 2004-05.

Wide variations could be seen in the performance and sources of growth across regions. On the whole, increased production of fruits has been attributed more due to area expansion than productivity enhancement, while, in case of vegetables, Spices and plantation crops, the productivity appears to have played significant role in enhancing production (Singh and Mathur, Awasthi), subject to sufficient backing by technical change. Technology development and diffusion appear to have played a dominant role in the states that were basically horticulture based with large areas under these crops.

Subhasis Mandal *et al.*, reported that investment in horticultural sector in North Eastern Region (NER) has started paying dividend but at a slower rate in comparison with its underlying potential. Fruit production has been encouraging but the same is not true with vegetables, while spices show constant growth rate. The potential for

off-season cultivation and cultivation under net houses or polyhouses need to be encouraged. Babilata Shroff, also indicated higher profits from crop diversification towards horticultural crops in upland farms in Orissa.

Bimal Kishore Sahoo and Simantini Mohapatra make a comparison of growth rate of per capita state domestic and per capita agricultural state domestic product with per capita horticultural production for different states. Per capita agricultural domestic product has been negative for a large number of states but had higher and positive per capita horticultural production. Per capita income, per cent urban population, road length, proportion of small holdings and number of tractors per 1000 ha of gross cropped area were positive and statistically significant, suggesting a need to access the factors that contributed towards horticultural development across different agro-climatic regions.

### III

#### DEMAND FOR HORTICULTURAL CROPS

The increased growth in horticultural crop production over the years could be inferred as demand lead one, as the average food basket changed from staple foodgrains to high value food crops. The share of fruits and vegetables in urban food expenditure increased from 12 per cent in 1983 to 14.9 per cent in 1993-94 and 15.6 per cent in 2004-05 (Birthal *et al.*, R. Chand, *et al.*). Value of consumption on vegetables and fruit and nut increased substantially from 1987 to 2005-06. The extent of expenditure was higher in the urban areas than in rural areas, suggesting a need for a discussion on this trend and arriving at means to bridge this gap. Among the states, Karnataka accounted for the lowest expenditure per person for vegetables, while Bihar for fresh fruits during 2005-06 (Sushila Kaul). No specific inference in terms of horticultural production of a state and the demand for the same could be drawn.

### IV

#### HORTICULTURAL GROWTH AND SMALL FARMERS

The CGIAR system prioritises high value crops, especially fruits and vegetables on the premise that they provide poor farm families the opportunity to derive additional income and increase enterprise stability through crop diversification (Singh and Mathur). Small farmers allocated larger proportion of their area to horticultural crops. Small farmers preferred vegetables due to their quicker returns, surplus labour and liquidity constraints, while large farmers allotted larger share on fruits, condiments and spices as they could afford the higher capital needs and longer gestation periods (Birthal *et al.*). Satyendra Prakash Gupta and P.K. Verma indicated higher profitability of watermelon, muskmelon, and pumpkin for small farm holdings, under the Mahanadi riverbed in Chhattisgarh. Distribution of area under horticultural crops over the years also reiterated the fact that small farmers



contributed higher percentage of their gross cropped area towards vegetable cultivation. However, the reasons for higher year to year variability in area under horticultural crops, needs further elaboration.

v

#### PROFITABILITY OF CROPS, CROP PRODUCTION AND PROFITABILITY

One of the main reasons for the increased popularity of horticultural crops in crop diversification could be their higher profitability over other crops. R. Chand *et al.*, has estimated the per hectare value of output of fruits and vegetables in the range of Rs.86,000 in comparison to Rs. 7,779 for cereals or Rs. 33,000 for sugarcane (at 1990 prices) and indicate similar trend in subsequent decades as well. Sufficient evidence has been generated on the higher profitability of horticultural crops (Mittal, 2007). Research across regions also has brought forward the higher profitability of horticultural crops over other groups. Onion among vegetables provides good returns (A.M. Rajput *et al.*), while a series of others like muskmelon, watermelon, cucumber, pumpkin and cowpea provide higher profits specially for the small and medium size group farms in the Mahanadi river bed (Gupta and Verma).

Adoption of improved technologies such as use of hybrids or high yielding varieties, integrated pest management practices have proved to enhance the profitability of vegetables across growing regions. Investment into horticultural crop research also has been increasing since the fourth plan period (Chand *et al.*, Singh *et al.* 2004). Technologies such as hybrids in vegetables like tomato and cabbage have proved to double farm productivity and more than double net return (Subrahmanyam and Sudha, 1997). Vegetable crops like tomato, cabbage, okra and brinjal have more than 40 per cent of the area under hybrids and improved varieties, leading not only to increased production but also to increased demand for hybrid seeds. This in turn has generated what could be called a 'technological spill over effect' in the form of on farm seed production of hybrids in vegetables in certain pockets that are mainly rainfed. The on farm hybrid seed production has gained popularity as assured and sustainable source of income and employment to a number of farm families, especially in rainfed farming regions. Allocating even less than 10 per cent of their farm land for commercial seed production provides the farmers with assured return in comparison to the marginal return from other regularly grown field crops (Sudha *et al.*, 2005). Input saving technologies such as integrated pest management, integrated nutrient management and judicious water use and water soluble nutrients have proved highly beneficial for a number of capital and labour intensive horticultural crops like tomato and grapes. However, the technology impact on horticulture did not get enough attention in this discussion. Water saving technology and enhancing water use efficiency is an important aspect that has been gaining popularity among farmers across the regions. Cultivation of seasonal and perennial horticultural crops under drip irrigation is gaining significance. Vijay Kumar Choudhary, assessed the

economics of vegetable cultivation under drip vs. conventional irrigation systems in Durg district, Chhattisgarh and concludes the useful impact of judicious use of water through drip system.

Changing global trade patterns in the post-WTO regime also provide ample scope for expanding area under medicinal and aromatic crops that were hitherto remain under utilised. Crop diversification towards such high value horticultural crops offers wide scope for small and marginal farmers. Some of the lesser known medicinal and aromatic crops like mentha (Japanese mint), aonla and Isabgol that have huge domestic as well as export potential have shown promise. A.K. Sharma *et al.*, studied the prospects of mentha cultivation in the Indo-Gangetic plains, that has over 1.2 lakh hectare area under this crop in Uttar Pradesh state alone. With an expenditure of Rs.30,000/ha, farmers could realise up to Rs. 63,987/ha as gross returns. The fact that mentha also fits in well as an intercrop into the paddy-wheat farming systems provides additional advantage for boosting its cultivation. In comparison to wheat, the sucker planted mint provided 32 per cent higher income. Aonla is yet another medicinal fruit tree that offers huge potential. H.O. Sharma *et al.*, estimate the profitability of Isabgol cultivation in Madhya Pradesh. Farmers could realise a net return of Rs. 11,639/ha with an expenditure of around Rs.14,760/ha. Isabgol cultivation could offer a profitable alternative to competing crop like wheat in this region. Most of the medicinal and aromatic crops and fruit trees like cashew being grown with minimal or no inorganic fertiliser application provide vast scope for obtaining premium price in the international market. However, the need for standardising technical knowledge on the cultivation of these crops has emerged as the most important constraint impeding the expansion of area under them. Shift from commercial crops like opium, vegetables and sugar cane to mentha, repeated cultivation resulting in higher returns has helped growers in enhancing their socio-economic status. Replacement of sugarcane by mentha sends a warning about remunerative prices of sugarcane.

In sharp contrast, the area under perennial fruit trees likes mango show declining trends over the years. Ramesh Chandra Mondal reported declining trend in productivity of mango across growing regions, with special reference to its cultivation in West Bengal. Production uncertainties such as biennial bearing, pest and disease incidence, inconsistent weather were the reasons for over 70 per cent of the mango growers selling the orchards on lease sales leading to poor maintenance and improper management. However, in comparison to the field crops of the region, horticultural crops fetch higher returns. Shalini Yadav and S.L. Kumbhare pointed out that loss in productivity and competitiveness in cashew production and processing due to senile and unproductive plantations, and advocate for phased replanting. Rejuvenation of old orchards with superior types in a phased manner, educating farmers on the advantage of self-marketing, providing marketing credit besides creating market and post-harvest infrastructure closer to production centres could

help replenish the economy of fruit tree growers (Kalamkar). The recently implemented National Horticultural Scheme aims at this objective.

Lack of information on production and marketing aspects could be impediments for successful cultivation of less known trees like guava. J. Rai and Rahul Kumar Rai estimate the establishment cost of guava orchard at Rs. 59,392/ha with a gestation period of three years. While the high cost and long gestation period often act as deterrents for fruit production, this could be overcome by intercropping with other field and horticultural crops. The scope for successful inclusion of wide variety of horticultural crops into different agro climatic regions has been the driving force of all crop diversification efforts towards horticultural crops. This trend has been visible in the area expansion under this crop group starting from the early 90s. However the absence of associated supporting factors such as technological advances, infrastructure and market regulation besides policy support could be the reason for declining growth rates of this set of crops in the recent years.

## VI

### POST-HARVEST HANDLING AND MARKETING

The need for effective and safe post harvest handling of highly perishable, seasonal and bulky produce of horticultural crops has been well researched. Estimates indicate that post harvest loss in horticultural crops to be to the tune of around 35 per cent of the produce valued at over Rs. 20 cores. Systematic measurement of physical and financial losses along the market chain indicated varying levels of loss depending on the type of produce and the mode of sale (Murthy *et al.*, 2002, Sudha *et al.*, 2005). Post-Harvest Loss (PHL) often is directly proportional to the length of the market channel. A.K. Gauraha and B.S. Thakur observed that the PHL in vegetables was higher in the range of 17 per cent of the marketed quantity as against 9.62 per cent in paddy and 7.57 per cent in gram. Higher loss for vegetables was mainly because of longer and widely varying market channels adopted as against sale to agricultural credit societies based in the village itself for cereals.

D.K. Singh and Hasib Ahmad stressed the need for appropriate storage facilities while marketing field and horticultural crops. A comparison of post-harvest handling and marketing of potato and wheat revealed that the PHL was the highest at the storage level. Non-availability of storage space in the cold storages and/or inappropriate storage structure adopted also had high influence on the proportion of loss. Quantum of loss was also proportional to the farm size category as also the wide fluctuations in the market price. Market related factors such as regulatory mechanisms including prevalence of minimum support price, adequate storage infrastructure had direct influence on the PHL. C. Hazarika estimated the PHL in ginger to be around 14.66 per cent, while the field level loss to the growers was around 4.68 per cent.

Babu Singh *et al.* estimated the PHL for onion and potato grown in Uttar Pradesh, which worked out to 10.42 kg/qtl for onion and 12.97 kg/qtl for potato. Field loss was the major loss in both the crops. Attempt at analysing factors that contributed towards PHL indicated that age, education and family type had negative effect on losses while, factors like weather, inadequate storage and inappropriate transport had positive impact.

Quantification of the economic loss along the market channels assumes the primary focus of any attempt at evaluating the post-harvest loss. Estimating the physical loss realised by each market intermediary and valuing at the price realised by each intermediary would provide accuracy in estimation and remove the arbitrariness' in estimation (Murthy *et al.*, 2003).

## VII

### MARKETING CHANNELS, PRICE SPREAD

Marketing of horticultural crops is risky and expensive considering their perishable nature and bulkiness. Direct sale to consumers is undoubtedly the most preferred mode of sale as market efficiency as well as the producers share in consumer's rupee is inversely proportional to the length of the marketing channels (Ripu Daman Singh *et al.*, B.N.S. Banafar and Suklu Ram Salam, A.R. Verma, S.C. Persoya *et al.*). Despite several deficiencies, co-operatives have emerged as the best alternative to the existing marketing channels, especially for fruits and vegetables. While there are marked differences among states in utilising co-operatives for marketing of fruits and vegetables, Gujarat and Tamil Nadu emerged as leaders with around 38 per cent and 10 per cent by 2003-04. The compound growth rate in value of fruits and vegetables marketed by co-operatives from 1985-86 to 2003-04 indicated 11.48 per cent for all India, which was highest at 25.85 per cent for West Bengal and 15.86 per cent for Tamil Nadu (Deepak Shah).

Inadequate storage facilities on farm or closer to production centre, absence or inadequate access to technical know-how for value addition continue to be the most pressing constraints impeding efficiency in the marketing of horticultural crops (K.N.S. Banafar and Suklu Ram Salam). According to Deepak Shah, NCDC has been actively involved in creating post-harvest infrastructure at the markets such as construction of go downs, grading and packing facilities, establishing pre-cooling facilities, etc., which has risen by 64 per cent from 1997 to 2004.

Access to markets, market information and the frequency at which it is available were the sole factors that need immediate address. M.S. Jairath suggests the creation of terminal market that operates on a hub and spoke model as the best corrective measure to overcome the constraints in horticultural marketing. While a number of cereals and pulses receive market intervention in the form of minimum support price, none except onion in the horticultural crop group qualified for the same. Immediate attention and requisite policy for arriving at such modalities are the need of the hour

for horticultural crops, given their growing significance in production across regions (Singh *et al.*).

One of the most important and decisive factors of profitability of horticultural crops, the price analysis and market behaviour including price forecasting did not get sufficient representation in this discussion, barring the study by Vasisht *et al.* Analysing intra-year variations, coefficient of variation of a wide range of horticultural crops, viz., apple, pine apple, potato and cauliflower, A.K. Vasisht *et al.*, indicate that markets for commodities having longer shelf life had better relationship. Infrastructure facilities like cold storage, timely access to market information were the main factors that needed to be researched in detail and improved. U. Arulanandhu *et al.* use useful techniques like instability index, ARIMA models for price forecasting for examining the market trends of cardamom exports over the years and concluded declining trend in exports in the future.

#### VIII

##### CONTRACT FARMING

While horticultural crop production is considered risky, the marketing risk in terms of failure of markets, frequent and wide fluctuations in prices have been identified as most pressing. Farmers adopt strategies such as crop and income diversification, intercropping and crop insurance for mitigating production risks. Among the many instruments of farmer risk management options, crop insurance against weather, yield or production risks, provision for Minimum Support Price (MSP), MIS, Income Insurance scheme and contract farming are important. Futures markets, warehouse receipt system and others like crop diversification etc., are already in place in several other countries. However, in India, such measures are not yet being adopted in horticultural crops, barring few attempts. Given the fact that the state is withdrawing from the markets and is not supporting producers directly, Contract farming seems to be the best solution for tackling market risk. Two papers dealt with the subject in this discussion.

Terms and conditions of the contract, especially that of the procurement price policy is of significance for success of contract farming. Innovative methods in pricing help the contracting firm as well the farmers on successful completion of the contract. Providing a 'safe price band' that includes a part fixed and a part flexible pricing, quality-based pricing and transport cost are some of the issues that help in the success of contract farming. Absence of insurance against crop failure is a glaring lacunae in most of the contracting agreements. Absence of contracting arrangements could be a major impediment for cultivation for lesser known or under utilised crops and regions such as medicinal and aromatic and plantation crops (Subhash Chand *et al.* and Shalini and Kumbhare).

Institutional innovation from an institutional perspective is important for understanding the reasons for success or otherwise of contract agreements. Using two

cases, viz., gherkins from Karnataka and tomato from Punjab, the study by S.R. Asokan and Anita Arya, makes an interesting point for smooth functioning of contractual relationships between firms and farmers. Accordingly, asset-specific investment for a particular transaction determines the endurance of the relationship. If the asset-specific investments of two contracting parties locked, the functioning is smooth. Expanding the scope of such studies could throw new light on the research on contract farming models.

Several new models of contractual relationships between farmers and private entrepreneurs and multinational companies dealing with horticultural commodities have emerged in the recent past, but none have been reported for the discussion in this forum. Vast scope exists for researchers to understand and evolve the functioning of these new models that revolve around new concepts like supply chain or value chain analysis.

## IX

### PROCESSING OF HORTICULTURAL CROPS

Development of processing sector for fruit and vegetable is critically important for the expansion and development of agriculture. In the era of liberalisation and globalisation, returns to diversification towards high-value commodities are conditional to the investment in post-harvest technologies for processing, quality and food safety (Pingali, 2006). Post-economic liberalisation period has witnessed changes in this sector. Besides its sunrise industry status, the growth of this sector has remained marginal over the years. Infrastructure, urbanisation and income growth have been identified as the major drivers for growth of fruits and vegetables processing industry in India. Bidhan Chandra Roy's paper and the study by Brahm Prakash *et al.*, analyses the role of fruit and vegetable processing for agricultural development and infers with growing infrastructure in the form of cold storages, expanding taxation, excise duties, etc., processing industry has demonstrated a multiplier effect of 2.4 per cent which is greater than the telecom sector as well.

Infrastructure, urbanisation and income growth are the major drivers for growth in fruit and vegetable processing industry. This could be the main reason for the concentration of processing facilities near big cities than closer to raw material production centres (Roy). The gainful employment generating capacity of processing sector needs no mention. Initiating and establishing appropriate public private partnerships could enhance benefits to both the participating groups. Shalini and Kumbhare systematically bring forth the advantages of such partnerships in enhancing employment opportunities through cashew processing.

## X

## TRADE AND EXPORT

Horticultural crop development in the early 1990s was thought to be an export-oriented one. Improved budgetary allocation and enhanced emphasis on horticulture did reflect in the increased share in agricultural exports from 5.32 per cent to 9.05 per cent between 1990-91 and 2005-06 (M.S. Deshmukh). The share of fruits and vegetables in total value of agricultural exports has increased from 9.5 per cent in 1980-81 to 16.5 per cent in 2003-03 (Golait and Pradhan). Rate of growth in export values of from 1995-96 to 2006-07 was around 14.5 per cent for total fruits and vegetables in comparison to 10.3 per cent for agricultural products. Fresh onions, fresh grapes and mangoes emerged leaders in fruit and vegetable group though with less stability (Singh and Mathur). Banana emerged as the crop having most export advantage both in quantity and value, but showed wide year to year fluctuations, followed by mangoes. In terms of revealed comparative advantage, it was mango that showed the highest value among fruits, while onion among vegetables while banana revealed the least comparative advantage.

The export performance of most horticultural crops showed increasing trends in the post-liberalisation period with stability, with cashew leading (Shalini and Kumbhare) and cardamom declining (Arulanandhu *et al.*). In contrast to the popular argument that horticultural development could trigger agricultural growth, Awasthi puts forth the argument on the contrary basing it on the increasing share of food grain exports in the value of total agricultural export against the declining share of horticultural products, warranting a discussion. The share of horticultural products in total value of agricultural exports has declined from 38 per cent in 1990-91 to 23 per cent by 2005-06, while that of food grains increased from 7.85 to 19 per cent in the same period.

## XI

## IMPACT ON INCOME AND EMPLOYMENT

It is argued that horticultural crops being labour intensive, increased area under these crops would enhance employment opportunities for rural poor (Joshi *et al.* 2004, R. Chand, *et al.* 2007) and this was corroborated in several case studies. In a macro level analysis, B.K. Sahoo and Simantini Mohapatra use fixed and random effect models on panel data taking state-wise total number employed in agriculture on per capita horticultural production regressed on share of small land holdings, etc., and inferred the results to be positive and statistically significant.

Impact of horticultural development programmes on employment generation in Konkan region for the period 1981-82 to 2000-01 indicated a significant growth rate of 10.29 per cent in the direct employment generation. A district wise analysis further strengthened the inference that growth rate in employment was higher in the districts

that had higher growth in area and production of horticultural crops (Tilekar *et al.*). R.B. Singh *et al.*, analysed the possibilities of increasing income and employment through optimum allocation of resources in vegetables. S.P. Saraswat *et al.*, indicated shifting from traditional crops to commercial crops like vegetables to be manifold remunerative in Himachal Pradesh.

R.R. Kushwaha, attempts to compare employment potential of horticultural crops with traditional crops. Jasmine (310 man days) over Crossandra, papaya (725) compared to fruit trees due to higher yield as well as prolonged harvest.

## XII

### GOVERNMENT INTERVENTIONS AND INITIATIVES

Keeping in line with the enhanced emphasis on horticultural development, state governments have initiated horticultural development programmes linked to employment guarantee scheme since 1991, the objectives being bringing around 2.9 million ha of cultivable waste under cultivation, convert land from low value to high value agriculture, generate employment, control soil erosion and improve economic status of farmers. The state also provided supplementary and complementary infrastructure in the form of green houses, tissue culture laboratories, agri-export zones, post-harvest management and horticultural training centres. The results based on the experience of Maharashtra revealed that the scheme has been successful in increasing the employment generation opportunities in the state through horticultural development (Sangeeta Shroff and Jayanti Kajale).

Deepak Shah brings forth various efforts made by several institutions in enhancing the post-harvest infrastructure for horticultural crops. The cumulative assistance sanctioned by various institutions like NHB, NCD, APEDA, NABARD, commercial banks etc worked out to Rs. 3000 crores, which is only 10 per cent of the actual investment required to develop PHI related facilities. The refinance facility created by NABARD for supporting horticultural crop related activities has grown from Rs 732 crores in 1983-84 to Rs. 8126 crores by 2004-05 registering a compound growth of 11.89 percent per annum. However, the share allocated towards plantation and horticulture forms hardly 3 to 4 per cent. In contrast, the ground level credit flows for horticultural crops has increased from Rs. 755 crores in 1997-98 to Rs.1,436 crores in 2003-04.

The efforts put forth by Maharashtra government towards horticultural development through employment guarantee scheme have not only benefited over 18 lakh beneficiaries, but also has resulted in 12.54 lakh hectares addition to the existing area under horticulture. With several other facilities, the state government has made an all round effort in diversification in favour of horticulture. Despite the initiatives by the state government, the schemes need market support for take-off. Organised retailing is the need of the hour.



## XIII

## ISSUES FOR DISCUSSION

- The growth rate of horticultural crops especially that of fruits and vegetables has shown slowing down trend in the post reform period. What could be the reason for this trend and how to overcome the same?
- How to tap the yield potential, when the technology contribution in horticultural crops is on the decline and growth rate in productivity is decreasing. How to increase the efficiency of technology and information transfer system?
- Can agro-climatic suitability be the main reason for regional variations in horticultural crop development across growing regions? Is it feasible and profitable to bring non-traditional areas under horticultural crops for increasing profitability of farm families?
- Wide variability is seen in the area under horticultural crops, especially vegetables across states. Is this due to small and marginal farmers shifting back and forth from production of horticultural crops? What should be the strategy to minimise such a trend?
- Technology development and diffusion appear to have played a dominant role in the states that are basically horticulture based with large areas under these crops – could this be true? If so why?
- Reasons for widening gap between demand for fruits and vegetables in the urban and rural areas and the means to bridge the same.
- Adoption of improved technology, technology spillover effects on income and employment across regions need to be examined.
- Are the methods of estimation adopted while estimating post-harvest losses appropriate?
- What are the alternate channels for marketing horticultural crops? Which is the best and how to incorporate that into practice?
- What could be the impact of new trends in retail marketing on small and marginal farmers cultivating horticultural crops?
- Are Government initiated employment guarantee schemes the solution for rural unemployment?
- Post-harvest infrastructure and investment into market regulation have been identified as the most missing links in the horticultural crop production. Why is there so much variation across regions and in the Government initiatives? How to unify them?

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