Triggering Agricultural Development Through Horticultural Crops*

H.P. Singh†

INTRODUCTION

The horticulture sector encompasses a wide range of crops, e.g., fruit crops, vegetable crops, potato and tuber crops, ornamental crops, medicinal and aromatic crops, spices and plantation crops. India, with its wide variability of climate and soil, is highly favourably placed for growing a large number of horticultural crops. It is the fastest growing sector within agriculture contributing towards poverty alleviation, nutritional security and it provides ample scope for farmers to increase their income and is helpful in sustaining large number of agro-based industries which generate huge employment opportunities. Presently horticulture contributes 28 per cent of agricultural gross domestic product (GDP). India has emerged as the world's largest producer of coconut and tea and the second largest producer and exporter of tea, coffee, cashew and spices. Only 2 per cent of the horticulture produce is processed, 0.4 per cent is exported and 22 per cent is lost or get wasted in the market chain. Exports of fresh and processed fruits, vegetables, cut flowers, dried flowers have also been picking up. India plans to increase the production of horticultural crops to 300 million tonnes by 2012 (Government of India, 2002) from the current level of 202.68 million tonnes (NHB, 2008).

On the demand side, the increasing purchasing power and more working women have positive impact on the changes in lifestyle and food consumption habits of the Indian population (Amarasinghe et al., 2007). The National Sample Survey (NSS) suggests that there has been a decline in per capita cereal consumption since the early 1970s (Radhakrishna and Ravi, 1992; Kumar and Mathur, 1997; Kumar, 1998; Bansil, 1999; Hanumantha Rao, 2000). Thus, using a 30 day reference period for food consumption, the average monthly per capita cereal consumption in the urban areas of India appears to have fallen from 11.24 kg in 1972-73 to 10.63 kg in 1993-94 and the corresponding rural figures are 15.26 and 13.40 kg (Joshi, 1998). It is estimated that to fulfil the increased demand for high value horticultural crops in

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South Asia, the production of these crops has to be increased by 142 per cent by 2020.

Rapidly the growing demand for horticultural products especially burgeoning market for processed fruits and vegetables as well as booming floriculture market is an evidence of the scope for accelerating horticultural growth in the country. Consequently, horticulture is set to assume a greater role and importance within the agriculture sector and eventually in the national economy. As a result of a number of thoughtful research, technological and policy initiatives and inputs, horticulture in India, today, has become a sustainable and viable venture for the small and marginal farmers. It is a matter of satisfaction that their food consumption levels and household income have increased. Besides, this sector has also started attracting entrepreneurs for taking up horticulture as a commercial venture. Therefore, there is great scope for accelerating agricultural development through expansion of horticultural crops.

II

CURRENT SCENARIO

On account of prevalence of diverse agro-climatic conditions and rich variability available in genetic resources, India can become the largest producer and exporter of horticultural crops. India leads the world in the production of mango, banana, sapota and acid lime. About 39 per cent mango and 23 per cent banana of the world are produced in India. The country has recorded highest productivity (25.4 tonnes/hectare) in the case of grapes in the world. In 1991-92, India produced 28.6 million tonnes of fruits from 2.87 million hectares of land and 58.74 million tonnes of fruits from 5.50 million hectares of land in 2005-06 recording the increase of 105.17 per cent in production and 91.97 per cent in area, respectively (Table 1). In case of vegetables in the same period the increase in area and production was observed to be 92.12 and 147.60 per cent, respectively (Table 2). In the reported period under major spices, the increase in area and production was recorded to be 6.98 and 83.73 per cent, respectively (Table 3).

### TABLE 1. AREA AND PRODUCTION OF FRUIT CROPS

<table>
<thead>
<tr>
<th>Year</th>
<th>Area ('000 ha)</th>
<th>Production ('000 mt)</th>
<th>Increase over 1991-92 (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>1991-92</td>
<td>2870</td>
<td>28630</td>
<td>-</td>
</tr>
<tr>
<td>1998-99</td>
<td>5140</td>
<td>58530</td>
<td>79.09</td>
</tr>
<tr>
<td>2005-06</td>
<td>5509.60</td>
<td>58740.30</td>
<td>91.97</td>
</tr>
</tbody>
</table>

*Source: Data base of National Horticulture Board (http://nhb.gov.in/).*
### TABLE 2. AREA AND PRODUCTION OF VEGETABLE CROPS

<table>
<thead>
<tr>
<th>Year (1)</th>
<th>Area ('000 ha) (2)</th>
<th>Production ('000 mt) (3)</th>
<th>Increase over 1991-92 (per cent) (4)</th>
<th>Area (4)</th>
<th>Production (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991-92</td>
<td>3729</td>
<td>44042</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1998-99</td>
<td>5870</td>
<td>87530</td>
<td>57.41</td>
<td>98.74</td>
<td></td>
</tr>
<tr>
<td>2005-06</td>
<td>7164</td>
<td>109050</td>
<td>92.12</td>
<td>147.60</td>
<td></td>
</tr>
</tbody>
</table>

*Source: www.agricoop.nic.in*

### TABLE 3. AREA AND PRODUCTION OF SPICES

<table>
<thead>
<tr>
<th>Year (1)</th>
<th>Area ('000 ha) (2)</th>
<th>Production ('000 mt) (3)</th>
<th>Increase over 1991-92 (per cent) (4)</th>
<th>Area (4)</th>
<th>Production (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991-92</td>
<td>1618</td>
<td>1211</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1998-99</td>
<td>1751</td>
<td>1884</td>
<td>8.22</td>
<td>55.57</td>
<td></td>
</tr>
<tr>
<td>2005-06</td>
<td>1731</td>
<td>2225</td>
<td>6.98</td>
<td>83.73</td>
<td></td>
</tr>
</tbody>
</table>

*Source: CMIE, 2005.*

### GROWTH IN MAJOR FRUIT CROPS

#### Temporal Changes in Area, Production and Productivity

During the period 1970 to 2006, the increase in area under papaya and citrus was more than seven times, followed by mango (approximately four times) whereas in case of banana and guava, area increased more than twice. Chand (2008) examined the compound growth rate and instability in area, production and productivity in the major fruit crops in India. The area under citrus registered the highest compound growth rate of 6.53 per cent followed by papaya (5.97 per cent), mango (4.12 per cent), banana (2.79 per cent) and lowest in guava (2.36 per cent). The production of papaya increased approximately 12 times followed by banana (7 times), citrus (4.5 times), guava (2 times) and lowest increase was observed in mango which was approximately 1.8 times only. Papaya registered the highest compound growth rate of 7.54 per cent per annum followed by banana (5.72 per cent), citrus (4.44 per cent), guava (1.92 per cent) and the lowest (1.34 per cent) one in the mango as far as production is concerned. A perusal of the table indicates a very disappointing picture with respect to growth rate of productivity in different perennial fruit crops. The yield of mango declined by 53.4 per cent, followed by citrus (46.4 per cent) and guava (18.8 per cent) from 1970 to 2006. There has been negative growth in the productivity of mango, citrus and guava fruit crops whereas the productivity of banana and papaya registered a positive compound growth rate of 2.94 and 1.80 per cent, respectively (Table 4). Thus, at the country level, increase in production was attributable mainly to increase in area under mango, guava and citrus crops.
TABLE 4. COMPOUND GROWTH RATE IN AREA, PRODUCTION AND YIELD IN MAJOR FRUIT CROPS IN INDIA DURING 1970-2006

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Banana</th>
<th>Papaya</th>
<th>Citrus</th>
<th>Mango</th>
<th>Guava</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Growth Rate</td>
<td>2.79</td>
<td>5.97</td>
<td>6.53</td>
<td>4.12</td>
<td>2.36</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.976</td>
<td>0.906</td>
<td>0.939</td>
<td>0.961</td>
<td>0.878</td>
</tr>
<tr>
<td>Production Growth Rate</td>
<td>5.72</td>
<td>7.54</td>
<td>4.44</td>
<td>1.34</td>
<td>1.92</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.956</td>
<td>0.841</td>
<td>0.908</td>
<td>0.802</td>
<td>0.771</td>
</tr>
<tr>
<td>Yield Growth Rate</td>
<td>2.94</td>
<td>1.80</td>
<td>-2.12</td>
<td>-2.77</td>
<td>-0.44</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.906</td>
<td>0.198</td>
<td>0.815</td>
<td>0.918</td>
<td>0.439</td>
</tr>
</tbody>
</table>

Source: Chand, 2008.

Instability in Area, Production and Productivity

The coefficient of variation (CV) in area was observed to be maximum in citrus (71.10 per cent) followed by papaya (54.41 per cent), mango (45.96 per cent), banana (30.58 per cent) and lowest in guava (26.94 per cent). In case of production maximum variability was observed in papaya (86.16 per cent) followed by banana (61.48 per cent), citrus (53.93 per cent), guava (23.71 per cent) and lowest in mango with 16.75 per cent. As for as yield is concerned the variability is very high in papaya (39.72 per cent) followed by banana (33.61 per cent), mango (30.14 per cent), citrus (25.39 per cent) and lowest in guava (7.17 per cent). Thus, the variability with respect to area, production and productivity is very high almost in all the fruit crops (Table 5).

TABLE 5. VARIABILITY IN AREA, PRODUCTION AND PRODUCTIVITY IN MAJOR FRUIT CROPS IN INDIA

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Banana</th>
<th>Papaya</th>
<th>Citrus</th>
<th>Mango</th>
<th>Guava</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>30.58</td>
<td>54.41</td>
<td>71.10</td>
<td>45.96</td>
<td>26.94</td>
</tr>
<tr>
<td>Production</td>
<td>61.48</td>
<td>86.16</td>
<td>53.93</td>
<td>16.75</td>
<td>23.71</td>
</tr>
<tr>
<td>Yield</td>
<td>33.61</td>
<td>39.72</td>
<td>25.39</td>
<td>30.14</td>
<td>7.17</td>
</tr>
</tbody>
</table>

Decomposition Analysis

The analysis of the factors affecting the total production of the fruits reveals that the area effect is maximum in mango (437 per cent) followed by citrus (206 per cent), guava (144 per cent), papaya (58 per cent) and minimum in banana (31 per cent). The contribution of productivity is negative in all the perennial fruits, whereas in the case of banana and papaya yield effect is positive but low. Thus, in case of all the fruit crops, the predominant factor responsible for increasing the production is area (Table 6).
TABLE 6. AREA EFFECT, YIELD EFFECT AND INTERACTION EFFECT ON PRODUCTION GROWTH OF MAJOR FRUIT CROPS IN INDIA DURING 1970-71 TO 2006-07

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Banana (1)</th>
<th>Papaya (2)</th>
<th>Citrus (3)</th>
<th>Mango (4)</th>
<th>Guava (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area effect</td>
<td>31.00</td>
<td>58.00</td>
<td>206.00</td>
<td>437.00</td>
<td>144.00</td>
</tr>
<tr>
<td>Yield effect</td>
<td>27.00</td>
<td>6.00</td>
<td>-15.00</td>
<td>-88.00</td>
<td>-17.00</td>
</tr>
<tr>
<td>Interaction effect</td>
<td>42.00</td>
<td>36.00</td>
<td>-91.00</td>
<td>-248.00</td>
<td>-27.00</td>
</tr>
</tbody>
</table>

IV

GROWTH IN MAJOR VEGETABLE CROPS

Temporal Changes in Area, Production and Productivity

The major vegetable crops grown in India are many but this study is confined only to potato and onion. During the period 1970 to 2004, the increase in area under potato was observed approximately three times followed by onion (2.6 times). The area under onion and potato registered the positive and significant compound growth rate of 3.19 and 2.99 per cent per annum, respectively. The production of potato and onion increased approximately five times and three times, respectively. The production of potato and onion registered positive and significant growth rate of 4.98 and 3.42 per cent per annum, respectively. The yield of potato increased 1.8 times followed by onion (1.13 times) only with a positive compound growth rate of 1.99 and 0.23 per cent per annum, respectively. The growth of productivity of onion is very low (Table 7).

TABLE 7. COMPOUND GROWTH RATE IN AREA, PRODUCTION AND YIELD IN MAJOR VEGETABLE CROPS IN INDIA DURING 1970-2006

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (1)</td>
<td>Production (2)</td>
</tr>
<tr>
<td>Growth Rate</td>
<td>2.99</td>
<td>4.98</td>
</tr>
<tr>
<td>R²</td>
<td>0.960</td>
<td>0.941</td>
</tr>
</tbody>
</table>

Instability in Area, Production and Productivity

The variability in potato and onion with respect to area and production is very high and it varies from 30 to 46 per cent (Table 8). In case of yield in potato the coefficient of variation is 20.77 per cent but it is low in onion (5.69 per cent).
TABLE 8. COEFFICIENT OF VARIATION IN AREA, PRODUCTION AND PRODUCTIVITY IN MAJOR VEGETABLE CROPS IN INDIA  

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Area (per cent)</th>
<th>Production (per cent)</th>
<th>Yield (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato (1970-71 to 2004-05)</td>
<td>29.63</td>
<td>46.40</td>
<td>20.77</td>
</tr>
<tr>
<td>Onion (1978-79 to 2004-05)</td>
<td>26.95</td>
<td>30.69</td>
<td>5.69</td>
</tr>
</tbody>
</table>

V

GROWTH IN MAJOR SPICES

Temporal Changes in Area, Production and Productivity

The major spices grown in the country are turmeric, chilli, black pepper, cardamom and coriander. The area doubled in the case of black pepper whereas in turmeric area increased 1.9 times followed by coriander (1.8 times) and in chilli and cardamom, the area is almost same from 1970 to 2003. Kumar (2008) has analysed the compound growth and instability in area, production and productivity in the major spices in India during 1970 to 2003. The area registered the maximum positive growth of 2.71 per cent in black pepper followed by turmeric (2.56 per cent). The compound growth rate in area under coriander, cardamom and chilli was observed to be only 0.93, 0.61 and 0.49 per cent, respectively. The production of coriander increased approximately 4 times followed by turmeric and black pepper (3.5 times), cardamom (3.3 times) and chilli (2.4 times). The production registered highest positive and significant growth rate of 6.01 per cent in turmeric followed by cardamom (4.47 per cent), black pepper (3.97 per cent), coriander (2.83 per cent) and chilli (2.54 per cent). The productivity increased 4 times in the case of cardamom and more than 2 times in chilli and coriander followed by turmeric (1.9 times) and black pepper (1.4 times). In case of all spices the yield registered positive growth rate. It registered the highest growth in cardamom 3.77 per cent followed by turmeric (3.46 per cent), chilli (2.03 per cent), while it was lowest in coriander (1.34 per cent) and black pepper (1.31 per cent) (Table 9).

TABLE 9. COMPOUND GROWTH RATE IN AREA, PRODUCTION AND YIELD IN MAJOR SPICES IN INDIA DURING 1970-2003

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Turmeric (per cent/annum)</th>
<th>Chilli (per cent/annum)</th>
<th>Black pepper (per cent/annum)</th>
<th>Cardamom (per cent/annum)</th>
<th>Coriander (per cent/annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>Growth Rate</td>
<td>2.56</td>
<td>0.49</td>
<td>2.71</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>R²</td>
<td>0.899</td>
<td>0.331</td>
<td>0.856</td>
<td>0.192</td>
</tr>
<tr>
<td>Production</td>
<td>Growth Rate</td>
<td>6.01</td>
<td>2.54</td>
<td>3.97</td>
<td>4.47</td>
</tr>
<tr>
<td></td>
<td>R²</td>
<td>0.871</td>
<td>0.769</td>
<td>0.831</td>
<td>0.861</td>
</tr>
<tr>
<td>Yield</td>
<td>Growth Rate</td>
<td>3.46</td>
<td>2.03</td>
<td>1.31</td>
<td>3.77</td>
</tr>
<tr>
<td></td>
<td>R²</td>
<td>0.802</td>
<td>0.714</td>
<td>0.613</td>
<td>0.883</td>
</tr>
</tbody>
</table>
Instability in Area, Production and Productivity

The variability in production was more as compared to yield and area. The coefficient of variation under turmeric was observed to be maximum (59.10 per cent) followed by black pepper (41.60 per cent) and cardamom with 40.33 per cent (Table 10). In case of productivity the maximum variability was observed in cardamom (38.81 per cent) followed by turmeric (38.46 per cent). In case of area, the variability of black pepper was more (28.97 per cent) followed by turmeric (25.49 per cent) and coriander (21.91 per cent).

<table>
<thead>
<tr>
<th>Particulars (1)</th>
<th>Turmeric (2)</th>
<th>Chilli (3)</th>
<th>Black pepper (4)</th>
<th>Cardamom (5)</th>
<th>Coriander (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>25.49</td>
<td>8.98</td>
<td>28.97</td>
<td>13.58</td>
<td>21.91</td>
</tr>
<tr>
<td>Production</td>
<td>59.10</td>
<td>29.09</td>
<td>41.60</td>
<td>40.33</td>
<td>36.88</td>
</tr>
<tr>
<td>Yield</td>
<td>38.46</td>
<td>26.16</td>
<td>15.80</td>
<td>38.81</td>
<td>23.69</td>
</tr>
</tbody>
</table>

Decomposition Analysis

In the case of turmeric the contribution of area, yield and interaction effect is almost equal. However, in case of chilli, cardamom and coriander yield effect is more than the area and interaction effect. In case of black pepper, area effect is more (52.95 per cent) than the yield and interaction effect (Table 11).

<table>
<thead>
<tr>
<th>Particulars (1)</th>
<th>Turmeric (2)</th>
<th>Chilli (3)</th>
<th>Black pepper (4)</th>
<th>Cardamom (5)</th>
<th>Coriander (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area effect</td>
<td>33.46</td>
<td>10.22</td>
<td>52.95</td>
<td>7.10</td>
<td>15.85</td>
</tr>
<tr>
<td>Yield effect</td>
<td>33.93</td>
<td>81.61</td>
<td>23.26</td>
<td>74.74</td>
<td>68.75</td>
</tr>
<tr>
<td>Interaction effect</td>
<td>32.61</td>
<td>8.62</td>
<td>23.79</td>
<td>18.16</td>
<td>15.40</td>
</tr>
</tbody>
</table>

INSTITUTIONS AND POLICY ENVIRONMENT FOR HORTICULTURAL DEVELOPMENT

The development of the horticultural sector is supported by a large number of institutions both at the central and state level. The National Horticulture Board (NHB) in the Ministry of Agriculture is the central institution responsible for facilitating the development of this sector. Its mandate includes (a) encouraging the development of commercial horticulture through demonstration farms; (b) developing post-harvest management infrastructure; (c) strengthening market information...
systems and maintaining horticultural database; (d) assisting R&D programme; and (e) providing training and education to farmers and the processing industry for improving agronomic practices and adoption of new technologies.

The National Cooperative Development Corporation (NCDC) under the Ministry of Agriculture is another important institution. Its objectives are: (a) to support fruits and vegetables marketing co-operatives by providing financial assistance; and (b) to provide financial assistance for post-harvest operations to co-operatives including assistance for purchase of transport vehicles, creation of cold storage and marketing infrastructure etc.

The research and education activities for horticulture are spearheaded by the Indian Council of Agricultural Research (ICAR) and its affiliated research centers. The horticulture division of ICAR has nine research institutes, eleven national research centers and thirteen coordinated research projects. The National Institute of Post Harvest Technology (NIPHT) is responsible for transferring post-harvest technologies to farmers, co-operatives and private sector. The National Institute of Agricultural Marketing (NIAM) provides specialised training, research and consultancy in agricultural marketing. The National Bank for Agriculture and Rural Development (NABARD) provides financial support for the horticultural sector and it has identified agro-processing activities for fruits and vegetables as major area of financial support.

The Directorate of Marketing and Inspection under the Department of Agriculture and Cooperation is responsible for enforcing and implementing the Agricultural Produce (Grading and Marketing) Act 1937 (as amended in 1986). Its mandate includes: (a) promoting standardisation and grading of agricultural produce including horticultural crops; (b) conducting market research and survey; (c) developing market regulations and infrastructure; (d) providing training on agricultural marketing; (e) promoting development of cold storage facilities; and (f) providing market information services. As of January 2005, the list of commodities with AGMARK standards included twenty-nine fruits and vegetables. Different grades and standards are laid out under AGMARK for domestic consumption and exports.

The primary responsibility for the development of food and vegetable processing sector lies with the Ministry of Food Processing Industries (MoFP). The MoFP is implementing a number of schemes covering (a) infrastructure development; (b) technology upgrading and establishment of modern food processing industries; (c) development of backward and forward linkage in the value chain; (d) strengthening of quality management; and (e) human resource and institutional development.

The horticultural sector has received considerable attention in recent years as it is recognised as a potentially important source of growth, employment generation and foreign exchange earning. The emphasis being given to this sector is reflected in the establishment of National Horticulture Mission in 2004 with an overall objective to enhance production of horticultural crops by 2011-12. The specific objectives of
National Horticulture Mission are: (a) doubling horticultural production to 300 million tonnes by 2011-12; (b) establish convergence and synergy among various on-going and planned programme in the field of horticultural development; and (c) promote the development and dissemination of technologies by blending traditional wisdom and frontier knowledge. The priority areas under the mission include horticultural research and development, improving post-harvest management and promoting processing and marketing of horticultural crops. Special attention is drawn to the promotion of horticultural export through establishment of focal Agricultural Export Zones (AEZs). Besides this, the horticultural sector has already benefited from economy-wide trade and regulatory reforms that have improved the overall investment climate for both domestic and foreign companies in India.

Some of the main reforms are: (1) removal of licensing requirements and government control over cold storage fees; (2) amendments of APMC Acts to allow contract farming, private sector investments in wholesale markets and direct marketing between buyers and sellers; (3) approval of foreign direct investment (FDI) in food processing and marketing with the exception of retail marketing; (4) removal/relaxation of quantitative restrictions on import and export of food items (except items on the negative list) and capital goods; (5) abolition of minimum export price (MEPs); and (6) tax reform including the adoption of VAT to replace purchase and sales taxes in several states.

VII

INSTITUTIONS INVOLVED IN HORTICULTURAL EXPORT

The Agricultural and Processed Food Products Export Development Authority (APEDA) is an autonomous organisation attached to the Ministry of Commerce is the apex agency for promoting agro-export including both fresh and processed horticultural products. It advises the potential exporters regarding the market requirements, organises product promotions and participates in international trade fairs to the standards for agricultural trade. The APEDA has also initiated numerous schemes to encourage exporters to upgrade their facilities in order to meet international requirements. These includes (a) assistance to exporters, producers, trade associations, public institutions and others for setting up laboratories; (b) assistance to exporters and producers for installing quality management, assurance and quality control systems such as International Standards Organisation (ISO) series, Hazard Analysis Critical Control Point (HACCP), Total Quality Management (TQM) etc.; (c) activities related to standardisation and quality control such as preparation of quality assurance manuals; (d) recognition of laboratories for export testing; (e) providing support for testing of pesticide residues, veterinary drugs, hormones, toxins and other contaminants in water and soil; (f) assistance to growers, manufacturers, exporters and export-related organisations of upgrading technical and managerial personnel through training in India; and (g) assistance to recognised associations of
growers/exporters for organising seminars/group activities including study tours within the country and for producing informational literature.

VIII

STATUS OF EXPORT AND IMPORT OF FRUITS AND VEGETABLES

Exports of horticultural products are dependant on factors such as domestic production and consumption, exportable surpluses, consumer preferences, varieties traded, quality, domestic and international prices and availability of infrastructure facilities for storage, post-harvest handling, etc. Having regard to the social and economic importance of the agricultural sector, the export strategy of the Government is based on the premise that foreign earnings from this sector should be enhanced thereby leading to higher income to farmers, taking care to make agricultural products available at reasonable prices to the domestic consumers.

Among fruits, mango was the main fruit exported. Export of fresh mango had commenced as early as 1925. Among vegetables onion has been the major crop exported from India. The APEDA has initiated a programme for an integrated training of horticulture producers for some identified fruits such as grape, mango, litchi, kinnow in the selected regions. The farmers have been provided training on integrated post-harvest management practices for better handling of the produce to ensure the export of quality products. APEDA is also making efforts to enhance the shelf life of fruits such as mango, grape, litchi through the use of controlled/modified atmosphere storage and use of refrigerator containers so that they could be transported by sea freight and achieve higher competitive advantage. In order to improve the quality of fruits and vegetables, pre-harvest manuals for certain fruits and vegetables have been prepared for dissemination to the farmers and producers.

Mango occupies a premier position among fruits export. Other fruits, which have attained significant position in export, are grape, walnut, citrus (kinnow), banana and apple. Small quantities of a number of other fruits, e.g., litchi, guava, custard apple, pineapple, papaya and tamarind are also in demand in the export market. Fresh vegetable export has been on the rise. The major vegetable exported is onion, with a share of 83.66 per cent in vegetable exports. Other crops with significant export include tomato, peas and cucumber (gherkin). Mixed vegetables export accounts for 12.63 per cent. The export of major vegetables from India is to South-East Asia and Middle East, except cucumber and gherkin which are exported to Europe and the U.S.A. High-value beans, peas, green chilli, etc., have good scope for export.

India has a long history of producing and exporting spices. The world trade in spices is estimated around 0.45 million tonnes. The country commands 46 per cent in global trade in terms of quantity and 28 per cent in terms of value. The major condiments and spices exported from India are pepper cardamom (small), cardamom (large) chillies, ginger, turmeric, coriander, cumin, celery, fennel fenugreek, other seeds (aniseed, ajwain seed, dill seed, poppy seed, mustard etc.), garlic, other spices
(tamarind, asafoetida, cinnamon, cassia, kokam, saffron, etc.), curry powder, mint oil and spice oleoresins and other oils.

The value of import and export data for India is obtained from the FAOSTAT database (www.fao.org) for the period of 1961 to 2005 and is presented in Figure 1. In 1961, the total import value of fruits and vegetables from the international market to India was US$ 37.70 million, whereas the value of export of fruits and vegetables to different countries was US$ 56.19 million. The net value of export of fruits and vegetables from India to different countries was US$ 18.49 million. The growth trend analysis for value of export of fruits and vegetable suggests that it is growing with a compound growth rate of 7.20 per cent per annum during the study period, whereas the value of import of fruits and vegetables has grown with a compound growth rate of 8.54 per cent per annum. During 1961 to 2005, India was the net exporter in terms of value of fruits and vegetables but it was net trade deficit during the years 1988, 1990, 2001, 2002, and 2003.

![Figure 1: Value of Import, Export and Net Export of Fruits and Vegetables, India](image)

**IX**

WORLD TRADE ORGANISATION (WTO) RELATED ISSUES

The objective of the agreement on sanitary and phyto-sanitary measures is to improve the health or life of human, animal and plant and overall phyto-sanitary situations in all the member countries. The sanitary and phyto-sanitary measures applied by each member country should be based on scientific justification and to the extent possible; it should take into consideration, the international standards and guidelines already available.

Article 3 states to harmonise the sanitary and phyto-sanitary measures, which basically include levels of food additives, contaminants, pesticide residues, microbiological criteria and other related toxins with the international standards and
guidelines. It means that the standards already available in India for fresh horticulture produce should be immediately harmonised with the international guidelines and if higher level of measures is required, the scientific justification for the same may be documented at the earliest. Article 4 of the agreement directs the WTO members to accept SPS measures of the other countries. Under this Article, WTO members can also enter into bilateral or multi-lateral agreements on mutual recognition of equivalence of specified SPS measures. The current trend is that many developed countries are entering into mutual equivalence agreements as it facilitates trade between the respective countries. This has been one of the reason for a more favourable treatment of products imported from developed countries as against products originating from developing countries resulting in the latter’s further marginalisation.

As per Article 5 of the agreement, countries are required to ensure that the measures of SPS protection are based on risk assessment on the basis of available scientific evidence, production processes and environmental conditions. Where scientific evidence is lacking, countries are required to obtain scientific evidence for a final position and within a reasonable time frame. According to Article 7 (transparency), all WTO members have an obligation to notify to the WTO committee, any changes in their SPS measures. They are also required to notify measures, which have a “significant effect on trade of other Members” and that depart from an international standard guideline or recommendation. As per Article 9, the WTO members are expected to facilitate technical assistance to other members especially the developing countries either bilaterally or through the relevant international organisations. This assistance may be in the areas of processing technologies, research and development, infrastructure, etc. and may be in the form of information, credits, grants, training and equipment to enable the countries to comply with the SPS measures necessary to achieve the level of SPS protection adopted by the importing country. As per Article 10 of the SPS Agreement, Special and Differential Treatment (SDT) is required to be provided to the developing countries, whereby, longer time frames for compliance with SPS measures are supposed to be provided by the developed countries. Moreover, the SPS Committee can grant developing countries specified time limit exceptions to comply with the application of the SPS Agreement.

**CHALLENGES FOR EXPORT OF HORTICULTURAL CROPS**

The challenges posed by the standards have manifested themselves in different ways (World Bank, 2006) for Indian horticulture and these include:

1. Absolute barriers or binding constraints for fresh mango entry into US, Japan and Australian markets;
(2) Temporary losses due to rejected and sometimes destroyed consignments of fresh or processed products;

(a) Grape consignment rejections in Europe,
(b) Border rejections of many small consignment of processed fruits and vegetables,
(c) Onion consignment rejections in Europe, and
(d) Periodic price discounts by private buyers.

(3) Higher consignment-specific or recurrent transaction costs due to duplicative testing, high levels of entry point inspection or further treatment of goods upon overseas market arrival;

(a) Pesticide monitoring programme for grapes,
(b) Fumigation of cut flowers in Japan,
(c) Stalled upgrading of mango pulp operations, and
(d) Good agricultural practices and smallholder vegetable growers.

(4) Patterns of “defensive commercialisation” whereby firms fail to pursue opportunities for remunerative trade with certain countries because of concerns about their inability to ensure compliance with regulatory standards in those markets.

(a) Processed fruits and vegetables sales by small and medium enterprises,
(b) Grape export strategies,
(c) Onion export strategies,
(d) Avoidance of certain cut flower markets.

(5) Looming Threats

(a) Heavy metals in fresh and processed vegetables,
(b) Pesticides in pomegranate,
(c) Requirements of traceability of fruits and vegetable growers (to identify/trace the producers of particular lot),
(d) Environmental and social requirements in cut flowers.

SANITARY AND PHYTO-SANITARY (SPS) MANAGEMENT IN HORTICULTURAL CROPS

In the context of horticulture, SPM (sanitary and phyto-sanitary measures) management involves combination of basic and more sophisticated technical and administrative functions (World Bank., 2005). It includes:
(a) Applying healthy agricultural practices and quality management at farm level;
(b) Applying healthy manufacturing practices, hazard analysis critical control practices and quality management at packaging and processing level;
(c) Maintaining the identity of products or raw materials;
(d) Regulation/registering the manufacture, distribution and use of agro-chemical;
(e) Applying quarantine procedures including for emergency situation;
(f) Carrying out pest/disease surveillance and information management;
(g) Developing or maintaining pest free area;
(h) Inspecting and licensing fruits and vegetables processors;
(i) Testing fruits and vegetable products for contaminants and microbiological content;
(j) Verifying/certifying propagating materials, i.e., seeds, seedlings etc.;
(k) Verifying/certifying imported or exported products related to known hazards;
(l) Reporting of possible hazards to trading partners; and
(m) Notifying WTO/trading partners of new SPM measures.

XII

NEW OPPORTUNITIES FOR EXPORT OF FRUITS AND VEGETABLES

**Organic Farming**

There is a need to promote organic farming in the production of different horticultural commodities with the objective of promoting exports and improving returns. There is, therefore, an urgent need to develop technology for organic farming and create awareness on the benefits it provides. This calls for standardisation of technologies for producing vermi-compost, bio-fertiliser and bio pesticides for different crops. There is also a need to develop guidelines for this purpose and designate agency/agencies for accreditation of such produce meeting international requirements. Government policies should be framed to facilitate strong backward and forward linkages in the agriculture sector (Singh *et al*., 2008).

**Import Substitution**

There is vast scope of reducing imports of horticultural commodities like dates, nuts like almond, pecan nut, pistachionut, macadamia nut, palm oil, raisins, cocoa and rubber. The area under such commodities needs to be increased. There is also need to develop commercial plantations of fruits like mangosteen, durian, longan, rambutan,
etc. which are commercially grown in most South Asian countries namely Thailand, Malaysia and Indonesia.

**Import Intimation System**

The need for having adequate, reliable and timely data in respect of import of commodities has become extremely necessary now in the context of opening up of the economy. There should be on line records about quantity, value, quality etc., of the commodities imported in the country so that both the government and interested entrepreneurs could make use of this information for various purposes. There is more urgent need for commodities like spices, cashew where international trade is sizeable.

**Products Having an Edge in International Market**

India being largely a tropical country, it is necessary to concentrate efforts on tropical horticultural crops such as fruits like mango, litchi, sapota, passion fruit, aonla, bael and guava and plantation crops like coconut, cashew, cardamon, black pepper, tea and coffee. Since most of the developed and importing countries are in the temperate region the chances of increasing our market share with such crops in this region are more. Apart from this, India is also very rich in medicinal plants. In order to promote export, R&D on these crops needs to be intensified and cultivation of crops with export potential needs to be promoted. In the case of coffee, there is a need to exploit the potential of Indian Arabica Gourmet Sector and of robusta in expresso segment.

**Intellectual Property Rights (IPR)**

In the present scenario of globalisation, it has become important to understand the implications of the IPR. A patent is a legal monopoly granted to the owner of any new invention, which is capable of being used for limited period of time. It is a privilege granted by the Government to an inventor and other persons deriving their rights from inventions. The patents also stimulate the technology process through diversification of products and upgradation of the technologies. The owner of a patent on a product/variety has full right to prevent others from making, using or importing this product without his consent. Presently, in India there is no legislation, which covers the protection of plant breeders rights. As a result, many of the foreign nurseries do not encourage the supply of horticultural crop varieties to India since their rights are not fully protected. Thus, India does not have access to many useful materials due to non-protection of plant breeder's right.
Quality Issues

In the light of recent changes in the international trade, to exploit the potential for export of horticulture produce to its full capacity, sincere efforts are required to develop a full fledged Quality Assurance Machinery. This proposal would affect the business of all sizes engaged in the production and trade of products and services throughout the supply chain. In addition to compliance with national legislation, this machinery will ensure that the following issues are considered.

- To ensure that all stages of production and distribution for which they are responsible are carried out in such a manner as to comply with food safety and consumer protection requirement;
- To inform the competent authority if it considers or suspects that a product placed on the market does not comply with the relevant food safety requirements and of action taken to prevent risk to the final consumer;
- That no product is exported which does not comply with the general requirements of the food laws;
- To have a system in place to identify the supplier of the product and the buyers or traders to whom they have supplied such products.
- To adequately label and identify produce to allow its traceability and withdraw the product if it considers or suspects that it is not complying with food safety requirements.

The above machinery would also be useful for ensuring that the products imported into India comply with conditions outlined above. In the present situation, there are chances that the developed countries could dump their products at throw away price to capture the Indian market along with the pests and diseases. Similarly it will ensure that genetically modified organisms (GMO) and microorganisms presently not existing in Indian soil do not enter into the food chain of the country.

There is a need to have a national approach for ensuring the quality and safety of food items including domestic, imported and exported products. This necessitates the overhauling of the current monitoring and control mechanism to ensure that the products entering into Indian market comply with the national food safety laws. In order to give a systematic approach to this important issue, a two-way action plan is suggested.
XIII

CONSTRAINTS IN DEVELOPMENT OF HORTICULTURAL CROPS

(1) **Inadequate Post Harvest Infrastructure and Processing Facilities**

The horticulture and plantation crops are both perishable and non-perishable in nature. Perishability alone contributes to heavy losses in the availability and quality after harvest of crops and makes investment risk oriented. The post-harvest handling accounts for 20 to 40 per cent of the losses at different stages of grading, packing, storage, transport and finally marketing of both fresh and processed products. Such an enormous loss has proved a great handicap in exploiting the full production potential of these crops and thereby improve the rural income, employment and nutrition of the masses. The production and marketing of these commodities also suffer from the crippling uncertainty and instability of the domestic as well as export market conditions. Since most of these are grown by small and marginal farmers, and handled at the retail level by poor sections, the effect is all the more devastating. Very often these commodities have to be sold through distress sales. To meet the domestic as well as international quality standards, upgradation, post-harvest marketing operations, e.g., harvesting, pre-cooled grading (cool chain), packing and transportation have to be improved. For international regulations it is also essential to have ISO systems of certification.

The weak processing infrastructure, as it exists today, has been one of the contributing factors for ineffective utilisation of the raw materials resulting in huge post-harvest losses. Further, price fluctuations commonly observed in the Indian horticulture scenario lead to glut situation in individual commodities and opens opportunities for exploitation of the small and marginal farmers by the traders and commission agents. Insufficient technologies for commercial utilisation of by-products/value added products also act as a dampner for handling horticulture produce. Lack of sufficient processing units for production of quality output is a major bottleneck for these crops. Lack of adequate standards for quality produce also hinders the export prospects of these crops. As small and marginal growers predominate the production sector, individual processing facilities are not available due to lack of skill as well as investment capability.

(2) **Poor Marketing Infrastructure**

Marketing of horticultural produce is a major constraint in the production and disposal system and has a major role to play in making the industry viable. Fruits and vegetables are mostly marketed through commission agents. A very small portion is handled by co-operative marketing societies. In the case of some fruits, the owners to the pre-harvest contractors also auction vegetables and flowers. The pre-harvest contract could be for one or even three years in perennial crops. The returns from
such arrangements are very low. Such sales also result in poor upkeep of the plantation/orchards and the contractors hesitate to make further investment in the upkeep of such plantations/orchards.

(3) **High Investments and Long Gestation Period**

The high capital cost involved in establishing an orchard/plantation, or rejuvenation of the existing old unproductive plantation poses serious constraint in the area expansion under these crops. The situation becomes all the more difficult in view of the large number of small holdings devoted to these crops which are essentially owned by weaker section, who have no means to invest, nor can afford to stand the burden of credit even if available. Added to this is the long gestation period that the perennial horticultural crops like mango, sapota, citrus and apple coming to the economic bearing age. This calls for liberalised credit facilities in easy instalments for repayment in the form of soft loans to small and marginal farmers to be introduced if the benefits of the horticulture industry are to be fully exploited. High cost of inputs and lack of enough incentives for production of quality varieties/species, product diversification, value addition, etc., also hinder crops development.

(4) **Post-Harvest Losses**

The horticulture produce suffers from heavy post-harvest losses in the absence of adequate post-harvest and marketing infrastructure, viz., pre-cooling units, packing and grading sheds, short and long term cold storage facilities, refrigerated containers, storage and phyto-sanitary facilities at airports. There is considerable loss in the amount of fruits and vegetables produced in India due to improper post-harvest operations, this result in a wide gap between the gross production and net availability. Assuming an average loss of 25 per cent (range varies between 8 to 37 per cent in various crops during different stages after harvest) in all the horticultural crops together, the losses are phenomenal. To minimise these losses, it is essential to analyse the contributing factors which result into these losses. The losses occur at the following stages:

- **Harvesting and pre-harvesting:** due to spoilage, spoilage and trimming.
- **Transport:** due to bruising, breakage and infection as a result of dust, heat, rain and humidity.
- **Storage:** due to over ripening or under ripening.
- **Processing and packing:** due to inefficiency and contamination.
- **Marketing:** due to loss of weight and quality with multi-level handling.
• The problem is further complicated due to the fact that there are no storage facilities at the farm level and the farmers are forced to dispose off the entire produce immediately on harvesting. This creates a glut situation in the market. Thus, the margins of the wholesalers and retailers are much higher than in the advanced countries.

(5) Trading and Marketing Bottlenecks

The horticulture marketing practices lack systems approach. The trading and marketing structure is very traditional and consists of a long chain of intermediaries. The farm-gate price available to the farmers is only 25 per cent of the retail price under Indian conditions whereas the same is 70 per cent in the case of Dutch and US farmers, where more efficient marketing system is in place.

(6) Sale of the Produce by Small and Marginal Farmers

About 75 per cent of the farmers sell their produce at the farm level to the village merchants, retailers, big producers or pre-harvest contractors. They cannot afford to transport their produce to the distant mandies on account of non-availability of transport facilities, high transportation cost, malpractices in the market such as heavy deductions, free samples of the produce, etc.

(7) Market Distortions

Trade and market distortions are many and some of these are high and unjust trading and market charges levied on producer-sellers, delayed payment, pooling by traders and lack of open bid system. Malpractices are rampant and the national market operates in a highly segmented manner.

(8) Banking Facilities

The branches of banks have been located in the market area but their mode of operation is similar to other banks and they do not give any preference to farmers/traders. In addition, there is no organised concessional credit available to these farmers.

(9) Market Intelligence

Information regarding demand, supply, price, market outlook, knowledge of consumers’ preference, marketing channels and practices are important for marketing of produce, which is limited to the terminal markets only at the moment. There is also lack of knowledge and equipment for grading and packaging of fruits and vegetables.
Exploitation by Commission Agents/Traders

The small growers are unorganised and lack group action and bargaining power, as a result these farmers are exploited by the traders. The small and marginal farmers are not attended to properly by the commission agents. These farmers have to wait for a long period for auctioning their produce.

FUTURE STRATEGY

To combat the wide spectrum of spoilage, the National Horticulture Board (NHB), besides few other agencies like Agricultural and Processed Food Products Export Development Authority (APEDA), Ministry of Food Processing Industries (MFPI), National Cooperative Development Corporation (NCDC), etc. started schemes during the IX Plan on the commercial production and management of post-harvest related infrastructural facilities at various levels of operation. The results shown by these programmes in a short span of time are indicative of the fact that the infrastructure so created has not only helped in reducing the losses to a significant level, but avenues of export have also been strengthened. The type of infrastructure created so far is the combination of individual components like grading/packing centres, pre-cooling units, cold storages, platform for collection of produce, transport vehicle and plastic crates/CFB boxes, etc. For an integrated development of horticulture industry and also to achieve our targets for feeding the population as well as for meeting the requirements of the processing industry and exports, emphasis on quality production needs to be integrated with post-harvest management of the highly perishable horticultural crops. Considering the role horticulture has to pay and the constraints in its development and the mandate of doubling food production and reducing the gap between requirement and availability, the following thrust areas are identified to be given due consideration for better post-harvest infrastructure:

- To act as a catalytic organisation for providing technical/financial support for all round development of horticulture sector. Emphasis should be laid on increasing production with an objective of achieving complete nutritional security.

- Encouraging adoption of appropriate post-harvest management technologies for maximising return to the farmers/growers.

- Feasibility studies for setting up the marketing, processing plants, cold storage, transportation system for raw and processed perishable horticultural products and other related fields and undertake designing, planning and execution of projects on their basis.
• Promotional activities to give boost to the process of employment generation, increase income of small and marginal farmers and involvement of women and backward communities in the horticulture development process.

• To encourage shifting food habits from quantity food to quality food through increased availability and mass media promotion of health oriented benefits of the consumption of fruits and vegetables.

• To stimulate private investment particularly in the fields of infrastructure, marketing and research and development with particular emphasis on the special needs of processing industry and exports.

XV

CORE AREAS OF INVESTMENT BY PRIVATE SECTOR

With a view to establish complete supply chain, from farm to the market, the infrastructure facilities will have to be created at the following levels:

(a) Small pre-cooling units and/or evaporatively cooled chambers in the production areas where the field heat of the produce is to be removed at a fast rate to bring down the temperature of the produce to the desired level before putting the product in the cold storages. The refrigerated transport units from the farm to cold storages are also utilised as mobile pre-cooling units for this purpose.

(b) Collection centre near to the farms.

(c) Medium to small cold storages having multi-product, multi-chamber facilities are the most popular segment where horticulture produce is stored in transit godown.

(d) Specialised cold storage with facility of built-in pre-cooling, high humidity and controlled/modified atmosphere are required for storage of the produce for a longer period. These specialised storages are essential for extending shelf life of the produce and without these facilities proper storage of the produce to meet the demand in the off season is not feasible.

(e) Other components like ripening chambers close to the markets and display cabinets at retail outlets.

(f) Linkages for conversion of fresh produce in other marketable forms.
In India, most of the exporters still rely on the traditional wholesale market to procure fruits and vegetables. The marketing channels for fruits and vegetables vary considerably by commodity and state, but they are generally very long and fragmented. The majority of domestic fruits and vegetables production is transacted through wholesale markets although depending on the state and commodity. The farmers may sell to traders directly at farm gate, to traders at village markets, or directly to processors, co-operatives and others. In majority of the states, the Agricultural Produce Marketing Committee (APMC) regulations have also prevented the private sector from investing in wholesale markets and in marketing infrastructure. As a result most markets have rudimentary infrastructure particularly for storing and handling the perishable products.

Recently, there has been an emergence of more coordinated supply chains for fruits and vegetables in India catering to export market and to the high end domestic market. The coordinated supply chain involves structured relationships among producers, traders, processors and buyers whereby detailed specifications are provided as to what and how much to produce, the time of delivery, quality and safety conditions and price. The coordinated supply chains fit well with the logistic requirement of modern food markets, especially for fresh and processed perishable foods. These chains can be used for process control of safety and quality and are more effective and efficient than control only at the end of the supply chain.

Recently, a terminal market for fruits and vegetables has been set up in Bangalore known as SAFAL. Physically, it can handle up to 1600 tonnes of produce per day. It is linked to 250 farmers associations and 40 collection centres that have been established in selected producing areas. The market receives sorted, graded and packaged produce from these associations and centers and then this is auctioned at the market. SAFAL also has forward linkages to a number of retail outlets. The market has modern infrastructure including temperature controlled storage facilities and ripening chambers.

Normally the small and marginal fruit and vegetable growers are unable to get remunerative price for their produce due to small marketable surplus and highly perishable nature of the produce. To support such farmers is the need of the hour. For this they should form a fruit and vegetable co-operative societies/self help groups (SHGs)/FIGs. A tentative model for fruit and vegetable cooperative society is presented in Figure 2. This will not only help in the marketing of small surplus of fruits and vegetables but also provide remunerative price of produce to the small and marginal farmers.
STRATEGIES FOR AUGMENTING PRODUCTION OF FRUITS AND VEGETABLES

The following strategies are proposed for augmenting production of fruits and vegetables.

Figure 2: Suggested Supply Chain for Small and Marginal Farmers

XVII
1. Improving Productivity and Production.
2. Reducing cost of production.
3. Improving quality of products for exports.
4. Value addition.
5. Marketing and Export.
7. Strengthening of organisational support.
8. Human Resource Development and

NOTE
1. Interaction effect is the combined effect of area and yield.

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