people for sedentary occupations. In the long run, investments on this somewhat innovative approach may prove valuable and cost-effective, benefiting both the management and the members of the staff. What with having to spend long hours commuting from their homes to their offices, the staff have hardly any time (or inclination) for physical training/exercise outside their office hours. In China, for example, a compulsory 15 minute break for physical exercise used to be provided in the offices. Subjects with BMI exceeding 25 will need special dietary advice and guidance in this regard.

If vigorous steps in these directions are instituted, it may be possible to arrest the escalation of the problem of overweight and with it, the problem of CHD and NIDDM as well.

References


India enjoys a rich diversity of horticultural crops covering large groups of fruits, vegetables, mushrooms, flowers, plantation and spices. This is possible because of the agro-climatic variations, enormous biodiversity, fertile soil, a large cultivable area and, above all, a long history of crop husbandry. This rich cultural diversity has further contributed to the planned exploitation of crops and trees, giving rise to a large variety of culinary recipes. The total area under these crops in 1994-95 was 14.5 million hectares with an annual production of 119.2 million tonnes (Table 1). Fruits and vegetables together contributed 90.2 per cent of this production and 65.8 per cent of the total area. The annual growth, both in area and production of these crops, has gained considerable momentum following planned diversification in Indian agriculture, encouraged by the government, from the eighth Five Year Plan onwards.

Today, India is the largest producer of fruits in the world, having a share of over 10 per cent and the second largest producer of vegetables with a global share of over 13 per cent. India is the largest producer of mangoes (over 54 per cent), bananas (over 15 per cent), chillies, ginger, corianders and cauliflowers. There is a vast variety of mangoes, numbering over 1,000, with several man-made hybrids being added to the list. India is home to wild species of mangoes, bananas, several cucurbits, beans, tuber crops, etc. Mushrooms have emerged as a fast-growing commodity both for domestic and overseas markets.

Several fruit crops have proved to be most remunerative for replacing subsistence farming in the rainfed, dry land, hilly, arid and coastal agro-eco systems. Diversification in

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<tr>
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</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>25.40</td>
<td>237.60</td>
<td>28.70</td>
<td>286.70</td>
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<td>Vegetables</td>
<td>58.00</td>
<td>608.80</td>
<td>51.30</td>
<td>585.30</td>
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<tr>
<td>Spices</td>
<td>16.78</td>
<td>12.70</td>
<td>20.05</td>
<td>19.00</td>
</tr>
<tr>
<td>Cashew</td>
<td>5.02</td>
<td>2.11</td>
<td>5.33</td>
<td>3.05</td>
</tr>
<tr>
<td>Areca nut</td>
<td>1.87</td>
<td>1.92</td>
<td>2.10</td>
<td>2.43</td>
</tr>
<tr>
<td>Total</td>
<td>118.97</td>
<td>907.70</td>
<td>122.77</td>
<td>961.09</td>
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</tbody>
</table>

Source: (i) Production Year Book: 1997 - National Horticulture Board (ii) Reports of the Working Group for VII and IX Plans
favour of horticulture crops is driven by hard economic factors. These crops are characterised by high productivity per unit area, much higher returns, higher potential for employment generation and exports, comparatively lower requirement of water, and easy adaptability to adverse soil and wasteland situations. The input-output ratio is much higher than the field crops. Their role in improving the environment is an added advantage. The biomass available from the tree crops is phenomenal, which either gets recycled into the soil to add to its fertility or is amenable to industrial use for value addition, further enhancing their economic viability.

Trends in favour of such a diversification are sweeping across the country. This is evident from the steady increase in the share of these crops in the total net (NCA) and gross cultivable area (GCA) of the country.

CONTRIBUTION TO THE NATIONAL INCOME

According to the National Accounts Statistics (1994), the total annual value of the horticultural products produced in the country in 1993-94 was $6,576 million, with fruits and vegetables together contributing over 65 per cent of this value. This value has been steadily increasing over the last three decades.

Fruits and vegetables together made a significant contribution to the national income, which progressed from $503 million in 1970-71 to $4,422 million in 1993-94.

ROLE IN HUMAN NUTRITION

Most horticultural crops play an important role in human nutrition, preventing diseases, and contributing to the nation's development and prosperity. Fruits and vegetables are not only rich and inexpensive sources of carbohydrates but also of minerals and vitamins, particularly calcium, iron and magnesium, and vitamin A and C, essential for building resistance against diseases. The energy (calorific value) produced by one hectare of these crops is much higher than that of cereals. Their role in combating the global problem of malnutrition, and more so of micronutrient deficiency, therefore, becomes obvious. It is indeed strange that while such natural food sources are available for combating micronutrient deficiencies within the country, some international agencies are trying to promote the use of foreign synthetic drugs for this purpose.

Under the "horticultural intervention, combined with nutrition education project" in Thailand, regular consumption of ivy gourd for three years brought down night blindness in children from 4.8 per cent in 1989 to 1.4 per cent in 1991. According to the ICMR, a balanced diet should constitute nearly 280 gm of vegetables, including tubers, and 90 gm of fruits per day. However, the average Indian diet had only 46 gm of fruits and 92 gm of vegetables in the 1980s which has improved in the last five years, particularly in urban areas due to higher income levels following economic reforms.

MAJOR CONSTRAINTS LIMITING PRODUCTION

Despite the potential explained above, the productivity and quality of most of the horticultural crops continues to remain much below the world average. It is only in case of a few crops such as grapes, coconut, potato and tapioca where Indian yields are comparable or even better. This situation is contributed to by several factors, the main being:

- **Old and unproductive plantations:** Out of the total area of over 4.5 million hectares under fruit orchards, more than 40 per cent area is currently under old senile or diseased plantations, contributing directly to the low averages in crop productivity. The area under vegetables including tuber crops, which are mostly annual or seasonal, is either being planted with seed/planting material of genetically inferior quality, or is affected by biotic or abiotic stresses. The well known belts of old mango orchards in Uttar Pradesh (UP), West Bengal and Andhra Pradesh, old and disease-infested apple orchards in UP hills, declining citrus groves of northeastern states, etc are some examples in support of the above statement. This area in most of the places covers prime locations with high economic potential, yet it is being wasted in the face of shrinking land resources. Unless this aspect is attended to with a vigorous campaign of either uprooting or rejuvenating the trees, this will continue to be a burden on the agricultural economy of the country.

- **Seed and planting material:** Inadequacy of genuine and disease-free planting material of improved varieties/cultivars of different crops has a major role to play in the low productivity and low quality of our crops. Although a large network of seed agencies and nurseries have come up in the country, the availability of seed/planting material of improved varieties is inadequate to meet the growing demands emerging from the expanding horticultural enterprise. This is further compounded by the absence of genetically superior material yet to be developed by the research agencies. Today, the entire planting material for production of cut flowers for exports is imported. There is no major source of supply of virus-free citrus plants. Nurseries involved in apple, banana plantations, etc, supply diseased material. Planting of seedlings instead of grafts/budlings of fruits is continuing in some places in the name of area expansion under state-subsidy programmes. The above situation is mostly a result of ignorance of farmers about the improved varieties available, the know-how about the selection of the right kind, and above all, the complete absence of a regulatory mechanism for certification.

- **Post-harvest management:** India is reported to be losing 20 to 30 per cent of the total harvest of fruits and vegetables produced annually, primarily because of the lack of adequate infrastructure, post-harvest technology relevant to our needs, and an effective and trained manpower/system for technology dissemination. This situation is a result of low priority accorded to this problem in previous years, both by the R&D and developmental bodies on this notion that higher productivity would compensate the losses. This has led to the continued adoption of unorganised marketing practices, very low share of farmers in the price consumers often pay in major consumption centres, frequent occurrence of glut situations forcing distress sale on producers and low quality, etc, which all combine together to snatch away the economic attraction which these crops hold, and keenness in the producer, especially the small farmer, to invest in improved...
technologies and better inputs.

Any major investment in improving crop productivity will prove infructuous in the absence of infrastructural facilities such as pre-cooling units, cold storages, refrigerated transportation, modernised market places, outlets, etc and above all, a well-tested post-harvest handling system for different products appropriate to our conditions. These can be created by adopting the well-tested concept of a 'Packing house', involving setting up of a post-harvest handling unit in each major production zone, where farmers bring in their produce for cleaning, sorting, grading, packing and pre-cooling, followed by either direct sale or putting in the cold store available at the house itself. These houses are generally owned by farmer groups, NGOs or even corporate units. A network of these packing houses are linked to a modernised wholesale market, which caters to the domestic and foreign markets.

As per rough estimates, the average cost of setting up such facilities comes to about $85.7 per tonne of fruit/vegetable, which means a total investment of about $8571.5 million would be required to handle only 30 per cent of the total production of over 100 million tonnes obtained in 1994-95. This challenge has to be met in a phased manner, using private investments in a major way and creating a congenial policy environment.

Post-harvest losses at the household level can be tackled using the low cost technology of zero energy cool chambers developed by the Indian Agriculture Research Institute (IARI), New Delhi. The chamber is a brick-walled structure with a sand layer in between two walls and a thatched cover. Regular sprinkling of water, an important aspect of the technology, helps keep the temperature around 25°C in the hot summers even when the outside temperature is over 40°C. At the same time, the relative humidity remains quite high, keeping the fruits and vegetables in a turgid state for a much longer time than under ambient conditions. This is not only cost-effective but also a simple technique, working on the principle of evaporative cooling. It can be easily promoted in urban as well as rural areas to reduce losses and, at the same time, help in promoting their consumption, which should be the major concern for all those involved in human nutrition, particularly fighting the problems of malnutrition in children and lactating mothers.

- Marketing of fruits and vegetables: Organised marketing of fruits and vegetables is almost absent. Consequently, fluctuations in daily prices and a large margin between the wholesale and the retail prices is a common feature. The large margins are meant to cover risks of loss due to perishability of the produce accentuated by the very weak post-harvest infrastructure. However, in commodities such as grapes, where organised marketing is done by the Grape Growers' Association in Maharashtra, backed by a strong infrastructure, the farmers are least exploited and the distribution is quite widespread, despite high degree of perishability of the fruits. Similar experiences are available with onions and mangoes in Maharashtra, apples in Himachal Pradesh and sapota in Gujarat, etc.

India has about 4,000 regulated markets of fruits and vegetables, most of which are in urban and semi-urban areas, using almost primitive methods. Any attempt to introduce organised marketing using modernised systems at the wholesale levels will have to be done in the face of stiff opposition of vested interests. Fruits (60 to 90 per cent) are generally marketed through pre-harvest contracts, while vegetables (70 to 98 per cent) are disposed off through commission agents. The marketing cost varies from 17 to 21 per cent of the market price in vegetables which includes commission at the rate of 7 to 10 per cent of the total value of the produce which is quite high. In fruits, the pre-harvest contractors carry away exorbitant profits at the cost of the producers, in some cases, being as high as 60 per cent on their investment. This can be avoided to a large extent if the marketing is undertaken by the farmers' organisation/cooperatives, or production is taken up under a contract farming system, which is gradually becoming popular, particularly for exports and processing.

- Processing of fruits and vegetables: It is estimated that out of the total production of fruits and vegetables in the country, only 0.5 to 1 per cent of the raw materials is processed, which compares very unfavourably with countries such as Brazil and the USA with 70 per cent utilisation, the Philippines with 78 per cent, Malaysia with 83 per cent and Thailand with 30 per cent. Although the total installed capacity in 1993 was about 12.6 lakh tonnes of processed products, the production was only about 5.6 lakh tonnes. Of the various products, fruit juices and fruit pulp account for 27 per cent, followed by ready-to-serve beverages and pickles being between 12 to 13 per cent each, jams and jellies 10 per cent and synthetics 8 per cent.

The other products are squash, tomato products, canned vegetables and others. Recent additions to these products are frozen pulps and vegetables, freeze-dried fruits and vegetables, fruit concentrates, aromas, packed vegetable curries, canned mushrooms and mushroom products, tomato paste, potato chips, etc.

Despite a large production base, the availability of raw material to the industry continues to be a major constraint. This has a strong relation with the per capita production of these commodities and India's share in the world exports of processed fruits and vegetables. For countries whose share in the world trade of processed fruits exceeded 3 per cent, the per capita production of fruits was three to 12 times that of India. Similarly, for countries whose share in the world export of processed vegetables exceeded 2 per cent, per capita vegetable production was two to five times that of India. For instance, per capita production of fruits in 1990 in India was only 0.03 tonnes while in Israel it was the highest (0.35 tonnes), followed by New Zealand, Brazil, Argentina, Chile, Turkey, Australia, etc in the range of 0.15 to 0.28 tonnes. In all these countries, utilisation of fruits and vegetables for processing is much higher than in India and their share in world exports is also equally high as compared to India.

The quality of the materials available in the country for processing is another limiting factor. The Indian production is made up of produce of different varieties and, therefore, lacks in uniformity in physio-chemical characteristics. Added to this, all varieties produced in large quantities are not suitable for processing, which in turn contributes to the poor output from a unit weight of the raw material used.
It is reported that 16 tonnes of Indian pineapple are needed to produce 1 tonne of its concentrate, as against only 8 tonnes of the Philippine pineapple. Similarly, 7 tonnes of Indian tomato will produce about 1 tonne of paste as against only 4 tonnes of Italian tomato. The price of the raw materials is another key factor contributing to its low availability to the industry. According to the Annual Survey of Industries (ASI), raw material input constitutes as much as 83 per cent of the value of the output. Indian prices are about two to four times higher than those prevailing in the international markets with respect to tomatoes, pineapples and oranges.

Data base: Despite the fact that the total annual production of horticultural crops is around 130 to 140 million tonnes as compared to over 190 million tonnes of foodgrain crops, the support for collection of statistical data on the area and production of these crops is inadequate. This is an aspect that requires attention.

DEMAND PROJECTIONS

The demand for fruits and vegetables has been worked out on the basis of the Recommended Dietary Allowance (RDA) of the ICMR, which lays down a minimum per capita consumption of 90 gm of fruits and 280 gm of vegetables including tubers. The demand has also taken into account requirement of the processing industry and for export. Accordingly, India will need about 60 million tonnes of fruits and 131 million tonnes of vegetables by the year 2002 to meet the requirements of a population of over 1 billion (Table 2). About 0.5 million tonnes of mushrooms are projected, with a major share for the processing industry.

It is now to be analysed whether this demand can be fulfilled in the coming five years. Looking at the constraints prevailing, long gestation periods of perennial crops, the inadequacy of infrastructure and other bottlenecks, the growth expected in the coming five years would not be enough to meet the total demand. Consequently, the targets for the Ninth Plan have been adjusted on the basis of growth rates expected. In case of fruits and vegetables, a growth rate of 5 per cent has been anticipated which would take our production to 56 million tonnes in fruits and 108 million tonnes in vegetables including tuber crops.

Using these projections, it is estimated that the total demand for the two commodities put together, by the end of the year 2002 (Ninth Plan), would be around 190 million tonnes, while the supply is expected to be 160 million tonnes. This will call for continued and consistent efforts on raising crop productivity and reducing post-harvest losses to make the country self-sufficient in these crops.

### STRATEGIES FOR THE FUTURE

The strategy for meeting the targets would primarily involve the existing plantations, in which efforts to improve their productivity should continue with more vigour and input of advanced technology. Going by the current data (1994-95), the average productivity of fruit and vegetable crops put together works out to slightly less than 9 tonnes per hectare. Our efforts should aim at least at increasing it by half-a-tonne per hectare per year on an average to provide an additional 25 million tonnes by the year 2002. Added to this will be the production expected from the newly planted areas as a part of crop diversification campaign. Some states have made ambitious programmes in this respect and are expected to convert a large area presently under dryland agriculture into horticulture estates. We envisage at least 13 per cent of the area to be diverted in the dry land/hilly/coastal belts which presently are growing annual crops with sub-optimal productivity. Added to this would be a large chunk of wastelands to be used for horticulture plantations which will add at least 3 million hectares to the area under these crops. Division of land in irrigated areas would, however, be very limited mainly in favour of high-value crops that are floriculture, vegetables, strawberry, etc. In other words, expansion in the area under horticulture crops would in no way be at the cost of areas under foodgrain crops or the inputs which are being used for these crops.

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### References