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SUBJECT III

**HORTICULTURE IN INDIA: ORGANISATION OF PRODUCTION,
 MARKETING AND PROCESSING**

**Horticulture in India - Production, Marketing
 and Processing***

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At the outset, it needs to be clarified that horticulture as a discipline of agricultural science encompasses study of large groups of fruits, vegetables, mushrooms, flowers, plantation crops including cashew, spices, medicinal and aromatic plants. India is rich in the diversity of these crops due to immense agro-climatic variations, enormous bio-diversity, fertile soil, large cultivable area and above all long history of crop husbandry. The rich cultural diversity of this country 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 Eighth Plan onwards. The total increase in area and production registered in 1994-95 over 1991-92 was 18.1 and 24.1 per cent, with an annual average growth rate of 4 and 8 per cent respectively (Table 2). As against this, the increase was only 3.2 and 5.98 per cent in area and production respectively during the period from 1984-85 to 1991-92. Based on the growth rates achieved in the early nineties, the area at the end of the Eighth Plan (1996-97) is likely to be 16 million hectares and production roughly around 141 million tonnes. This would mean an increase of 30.9 and 46.8 per cent between 1991-92 and 1996-97 (estimates). Fruits, vegetables and also coconut have contributed maximum to this growth.

TABLE 1. AREA AND PRODUCTION OF HORTICULTURAL CROPS
 (area in lakh ha; production in lakh tonnes)

Commodity (1)	1984-85		1991-92		1994-95		1996-97 (estimates)	
	Area (2)	Production (3)	Area (4)	Production (5)	Area (6)	Production (7)	Area (8)	Production (9)
Fruits	25.40	237.60	28.70	286.70	35.71	388.35	45.40	469.70
Vegetables	58.00	608.80	51.30	585.30	59.70	686.82	61.20	808.00
Spices	16.78	12.70	20.05	19.00	24.01	24.66	25.40	27.80
Coconut	11.90	44.57	15.29	65.00	16.90	85.62	20.00	97.50
Cashew	5.02	2.11	5.33	3.05	6.35	4.18	6.27	4.50
Areca nut	1.87	1.92	2.10	2.43	2.35	2.72	2.45	3.05
Total	118.97	907.70	122.77	961.09	145.02	1,192.35	160.72	1,410.55

Sources: (i) *Production Year Book 1997*, National Horticulture Board, Ministry of Agriculture, Gurgaon, Haryana.
 (ii) *Reports of the Working Groups for Seventh and Ninth Plans*, Planning Commission, Government of India, New Delhi.

* Keynote paper.

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TABLE 2. GROWTH IN AREA AND PRODUCTION OF HORTICULTURAL CROPS

Commodity (1)	<i>(per cent)</i>					
	In 1991-92 over 1984-85		In 1994-95 over 1991-92		In 1996-97 (estimates) over 1991-92	
	Area (2)	Production (3)	Area (4)	Production (5)	Area (6)	Production (7)
Fruits	13.0	20.5	24.4	35.6	58.2	35.6
Vegetables	(-)11.5	(-)3.7	12.0	17.3	19.2	38.1
Spices	19.5	49.6	20.0	27.8	27.0	46.3
Coconut	28.5	45.8	10.5	31.7	30.7	50.0
Cashew	6.2	44.5	19.1	37.0	-	50.0
Arecanut	12.3	26.5	11.9	11.9	16.6	25.5
Total	3.19	5.96	18.1	24.1	30.9	46.8

Today India is the largest producer of fruits in the world, having a share of over 10 per cent and second largest producer of vegetables with a global share of over 13 per cent. We are the largest producers of mango (over 54 per cent), banana (over 15 per cent), cashew (over 56 per cent), coconut (in terms of number of nuts produced), chillies, ginger, coriander and cauliflower. In cashew, we meet over 60 per cent of the world's export demand. Among fruits, India leads the world in varietal collections of mango, numbering over 1000 with several man-made hybrids being added to the list. India is the home of wild species of mango, banana, several cucurbits, beans, tuber crops, etc. Floriculture and mushroom have emerged as fast growing commodities both for domestic and overseas markets. Cocoa is gaining lost ground as an inter-crop in coconut and arecanut plantations in coastal areas, while oil palm is making significant advance in a few selected southern states.

HORTICULTURAL CROPS AND DIVERSIFICATION IN AGRICULTURE

The author had in 1989 analysed at length the role of these crops in crop diversification, human nutrition, and industrial growth and in generating income and employment under Indian situation. That analysis is more valid today when Indian agriculture is getting more and more commercialised and competitive. These crops have been identified as most remunerative crops for replacing subsistence farming in the rainfed dryland, hills, arid and coastal agro-ecosystems. Diversification in favour of horticultural 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 easily adaptable (particularly tree crops) to adverse soil and wasteland situations. The input-output ratio is much higher than the field crops. Their role in improving environment is an added advantage. The biomass available particularly 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, thus 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. In 1984-85, these crops covered over 7 per cent of the NCA and 5.9 per cent of GCA, while in 1991-92, the coverage rose to 8.6 and 6.7 per cent and in 1994-95 to 9.7 and 7.2 per cent respectively. At this rate the coverage is expected to go up further to 10.5 per cent of NCA and 8 per cent of GCA in 1996-97. States like Maharashtra, Karnataka, Haryana, Punjab, Kerala, Andhra Pradesh, Gujarat, Rajasthan, etc., have taken lead in this diversification. In Kerala, the area under rice, pulses and sugarcane has steadily gone down registering a decline ranging from 17 to 49 per cent in the last ten years, while the area under fruits rose by 514 per cent in the same period (Table 3). Similar is the case in Karnataka where coarse grains and pulses have yielded area to horticultural crops like fruits, vegetables and garden crops in the order of 15 to 42 per cent. In this state, oil palm, a newly introduced oil crop, is taking a sizeable area in the irrigated belt, while cocoa, as an inter-crop, is spreading as another industrial crop. In the northern state of Punjab, millets, pulses and maize have yielded place to fruits and vegetables during this period, the latter two increasing by 43 and 61 per cent respectively. Rice too gained ground in the process. In fact, the State Government came out in open support of diversification in favour of fruits and vegetables, endorsing the recommendation of Johl Committee (Government of Punjab, 1986) and fixed the targets under these crops at 6.4 per cent of the total cultivated area of the state by 2000 A.D. In Gujarat, the increase in the area under fruits, vegetables and spices in 1994-95 ranged between 31 and 47 per cent since 1985-86, while in Andhra Pradesh it ranged between 40 and 45 per cent.

TABLE 3. PERCENTAGE INCREASE OR DECREASE IN AREA BETWEEN 1985-86 AND 1995-96

Crop (1)	Kerala (2)	Karnataka (3)	Punjab (4)	Maharashtra (5)
A. Field crops				
Rice	(-) 28.8	10.3	19.4	(-) 0.6
Coarse grains	91.8	(-) 42.1	(-) 19.5	(-) 13.1
<i>Kharif</i> pulses	(-) 49.3	(-) 15.3	-	(-) 3.3
<i>Rabi</i> pulses	(-) 16.5	(-) 25.3	(-) 31.2	(-) 7.1
Sugarcane	(-) 23.6	66.6	38.0	107.8
Wheat	-	(-) 19.2	2.9	-
B. Horticultural crops				
Fruits	514.3	31.7	43.0	-
Vegetables	(-) 12.5	38.7	61.0	-
Spices	31.1	-	-	-
Cashew	(-) 30.0	11.2	-	-
Coconut	30.9	-	-	-

Horticultural Crops and Income

According to the *National Accounts Statistics* (Government of India, 1994, pp. 163-165), the total annual value of the horticultural products produced in the country in 1993-94 was Rs. 23,016 crores, with fruits and vegetables together contributing over 65 per cent of this value (Table 4). This value has been steadily increasing since the last three decades. It increased by about 300 per cent between 1970-71 and 1984-85 and by over 78 per cent in the last 10 years. These crops claimed a share of 34.5 per cent of the total value of the

agricultural produce, despite the former covering only 7.2 per cent of the gross cropped area. This share has more than doubled that in 1984-85, when it was only 16.5 per cent. Earlier to that in 1970-71, it was only 15.3 per cent, thus confirming the fact that economic liberalisation boosted the growth of these crops.

TABLE 4. VALUE OF HORTICULTURAL PRODUCTS

Items (1)	(Rs. crores)			
	1970-71 (2)	1984-85 (3)	1991-92 (4)	1993-94 (5)
(i) Total agricultural products	17,561	64,673	61,742	66,691
(ii) Total horticultural products	2,692	10,692	20,213	23,016
(iii) Fruits and vegetables	1,760	6,822	13,624	15,477
(iv) Percentage share of (iii) over (ii)	65.4	63.8	67.4	67.2
(v) Percentage share of (ii) over (i)	15.3	16.5	32.7	34.5
(vi) Percentage increase of (ii) over 1970-71	-	297.2	650.2	755.0
(vii) Percentage increase of (ii) over 1984-85	-	-	89.0	115.3
(viii) Percentage increase of (ii) over 1991-92	-	-	-	13.9

Source: Government of India (1994).

Comparison of cost-benefit analysis of these crops further confirms their potential for generating higher income per unit area. In typical dryland situations of Rayalaseema and Telangana tracts in Andhra Pradesh, the benefit-cost ratio (BCR) for mango was 3.39 as against 1.67 for groundnut and 1.71 for sorghum (Sudha and Reddy, 1987). The total value added by these crops to a unit area is also much higher than that by cereal and other crops, as compared by Sengupta (1986). At 1986 prices, the value added per hectare by fruits was Rs. 9,418 and by vegetables Rs. 5,829, as against Rs. 1,629 by wheat, Rs. 2,219 by rice and Rs. 5,288 by groundnut. Extending the comparison to the export potentials, the per hectare export earning at 1995-96 prices (in US \$) of mango was \$ 4,446, of grapes \$ 10,407, and of vegetables \$ 2,892, while for wheat, it was only \$ 416, for rice (non-basmati) \$ 466 and for rice (basmati) \$ 976.5 (Table 5). This is due to higher yields per hectare combined with higher unit price in international markets available for horticultural commodities. This provided a strong ground for several governmental policy initiatives in the last ten years encouraging free imports of seed and planting material of horticultural crops, liberalising procedures, extending tax reliefs, introducing several incentive packages, etc., for promoting their exports to earn foreign exchange.

TABLE 5. FOREIGN EXCHANGE EARNINGS PER HECTARE

Sr. No. (1)	Crop (2)	Average fob export* price (US \$/tonne) (3)	Average yield** (tonne/ha) (4)	Gross foreign exchange (US \$/ha) (5)
1.	Wheat	165	2.5	412.5
2.	Rice (basmati)	651	1.5	976.5
3.	Rice (non-basmati)	233	2.0	466.0
4.	Vegetables: mango	494	9.0	4,446.0
5.	Grapes	698	15.0	10,407.0
6.	Vegetables	241	12.0	2,892.0

Sources: * *Export Statistics for Agro and Food Products - India 1995-96*, Agricultural and Processed Food Products Export Development Authority, New Delhi.

** *Agricultural Research Data Book 1996*, Indian Council of Agricultural Research, New Delhi.

Horticultural Crops and Human Nutrition

Most of the 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 cheap 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, therefore, becomes obvious. According to the World Health Organisation (WHO) (1992), 190 million people are at risk of vitamin A deficiency (VAD), and over 2 billion are suffering from iron deficiency anemia (IDA). Children, and pregnant and lactating mothers are the most vulnerable to the disorders linked to these deficiencies. The global commitment to eradicating micro-nutrient deficiencies, particularly VAD emerged at the International Conference on Nutrition (ICN) held in Rome in 1992. At the national level, management of VAD and IDA is a vital element of the National Nutritional Policy, providing for promotion of regular intake of foods of plant origin rich in vitamin A and iron. Consumption of fruits and vegetables will, therefore, be crucial to the success of the strategy conceived under the above policy.

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 (Vir, 1996). Similar results were reported from Bangladesh and India under this project. According to the Indian Council of Medical Research (ICMR), a balanced diet should have nearly 280 grams of vegetables including tubers, and 90 grams of fruits per day. However, the average Indian diet had only 46 grams of fruits and 92 grams of vegetables in the eighties, which has now improved in the last 5 years, particularly in urban areas due to higher income levels following economic reforms.

STATUS OF HORTICULTURAL EXPORTS

Horticultural products exported from India were valued at Rs. 3,144.4 crores in 1995-96, accounting for over 25 per cent of the total export of agricultural commodities in the same year (Table 6). Export of these commodities increased by over 302 per cent between 1983-84 and 1991-93, and by over 80 per cent between 1991-92 and 1995-96. Major commodities in the export basket are cashewnut, spices, fresh fruits and vegetables, processed products, cut and dry flowers, and seeds. Of these, cashew leads with an overall share of about 41 per cent of the total value of horticultural exports. Among fresh fruits, mango, particularly Alphonso, Kesar, Dasheheri and Banganpalli varieties, and grapes constitute the bulk of the exports. Other fruits being exported in smaller quantities are banana, sapota, litchi, kinnow, etc. In vegetables, the bulk of the exports is made up of onion and potato. Other vegetables being exported in smaller quantities are okra, brinjal, tomato and chillies. Presently most of our exports, particularly in mango and vegetables, are made to West Asian countries, such as Saudi Arabia, Bahrain, Kuwait, etc. Mango is not allowed into U.S.A., Europe, Australia, New Zealand and Japan because of fear of fruit fly infestations, for which Vapour Heat

Treatment of fruits is mandatory before exports are considered. Grapes, however, have been quite popular in Western countries because of their excellent quality and availability during European winter/spring months.

TABLE 6. EXPORTS OF HORTICULTURAL PRODUCTS

Commodity (1)	<i>(Rs. crores)</i>		
	1983-84 (2)	1991-92 (3)	1995-96 (4)
Fresh fruits and vegetables	155.16	351.7	531.2
Floriculture	-	14.55	60.15
Fruit and vegetable seeds	-	N.A.	43.50
Spices	109.26	394.39	785.90
Cashewnut	156.62	675.52	1,245.00
Processed products	12.12	305.12	491.60
Total	433.16	1,741.28	3,144.40
Percentage increase over 1984-85	-	302.0	626.0
Percentage increase over 1991-92	-	-	80.6

Source: DGCIS (Directorate General of Commercial Intelligence and Statistics), Report ending March 1996, Ministry of Commerce, Government of India, New Delhi.

N.A. = Not available.

India is the major exporter of cashew kernels, and enjoyed complete control on the export market upto 1970 with more than 90 per cent share of the world's exports. However, the situation changed gradually with the entry of Brazil into the world trade, reducing Indian share, which now is over 64 per cent. During 1995-96, India exported over 98,000 tonnes of kernels valued at over Rs. 1,232 crores, exceeding the target of 76,418 tonnes fixed for the Eighth Plan. Apart from kernels, other products of high value for exports are cashewnut shell liquid (CNSL), cashew shell, tannins, etc. In spices, India has emerged as one of the largest exporters of red chillies. Other spices exported from India are black pepper, small cardamom, ginger, turmeric, spice oil and oleoresins.

In floriculture, the export of cut flowers is a recent phenomenon, following economic reforms introduced in 1991-92, allowing easy import of technology including planting material, incentives for exports, etc. The total world trade in floriculture products is expanding annually at 15 per cent. Our contribution to the world trade is quite insignificant, but the encouraging feature is that the Indian entrepreneur has been able to compete in the international market on his own, and the Indian cut-flowers have met the international standards. Consequently, new markets other than Holland are gradually showing interest in our flowers. Most significant among these is the Japanese market, which is likely to grow in the future. This sector has also been attracting foreign companies for setting up joint ventures both for technical know-how and for investments for equity participation. More than 200 proposals were received by the Government of India for clearance between 1991-92 to 1996-97, of which nearly 100 were carrying foreign investment of over Rs. 160 crores for total project costs of over Rs. 2,000 crores. However, not many have so far got off the ground for different reasons, more important being acute financial constraint due to reluctance of the banks to advance loans to such projects.

MAJOR CONSTRAINTS LIMITING PRODUCTION

Despite the potential explained above, the productivity and quality of most of the horticultural crops continue to remain much below the world average. It is only in a few crops such as grapes, coconut, potato, and tapioca where our yields are comparable or even better. This situation is contributed by several factors, of which major ones are elaborated as follows:

(a) *Old and Unproductive Plantations*

Out of the total area of over 6.5 million hectares under permanent/tree crops, at least more than 40 per cent of the area is currently under old/senile or diseased plantations, contributing directly to low averages in crop productivity. Rest of the area, particularly annual or seasonal crops, 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, West Bengal, and Andhra Pradesh, old and disease infested orchards of apple in U.P. hills, declining citrus groves of north-eastern states, root-wilt affected coconut gardens in Kerala, seedling forests of cashewnut in the four southern states, phytophthora infected black pepper gardens of Kerala, etc., are some of the glaring examples in support of the above statement. This area in most of the places covers prime locations, with high economic potential, but yet is being wasted in the face of shrinking land resources. Unless this area is attended to with a vigorous campaign of either uprooting or rejuvenating the trees, this will continue to be a drag on the horticultural economy of the country.

(b) *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, yet 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 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 black pepper, apple, banana, etc., supply diseased material. Planting of seedlings instead of grafts/buddings 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, know-how about the selection of right kind, and above all complete absence of regulatory mechanism for certification. Nursery Registration Act is yet to be enacted in most of the states. This has to be followed by Nursery Certification Act, using the provisions already existing in the Seed Act currently in vogue. Draft bills have been developed by Tamil Nadu and Maharashtra only so far. Enforcing the provisions of the Act would in itself be a tough proposition as and when it is passed by the respective state legislatures. However, it is high time that such an Act is introduced on a priority basis, if we are seriously interested in avoiding wasting the land and other resources required to grow these crops, and if we have to meet international quality standards and be competitive.

The dimensions of the problem can be gauged from the increasing demand for the planting material in the coming years. As per the estimates of the Ministry of Agriculture of the

Government of India, the total requirement of planting material of fruits, coconut, cashew, black pepper, tree spices, arecanut and cocoa will be roughly of the order of 1,400 million by 2002. This kind of demand will mean mushrooming of new nursery units in the coming years, which will further compound the problem. It is worth considering that assistance for horticultural development from the Centre be made conditional to the introduction of statutory regulatory mechanism in the state.

(c) Post-Harvest Management

India is reported to be losing 20 to 30 per cent of the total harvest of horticultural commodities produced annually, primarily because of lack of adequate infrastructure, post-harvest technology relevant to our needs, and machinery for technology dissemination. This situation is a result of low priority accorded to this problem in previous years, both by the research and development (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 consuming centres, frequent occurrence of glut situations forcing distress sale on the producers, low quality, etc., which all combine together to snatch away the economic attraction which these crops hold the world over, 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 'Packing House', which involves setting up of a post-harvest handling unit, called a packing house, in each major production zone, where the farmers bring in their produce for cleaning, sorting, grading, packing, pre-cooling, followed by either direct sale or putting in the cold store available at the 'house' itself. These houses are generally owned by farmers' groups, non-governmental organisations or even the corporate units. A network of these packing houses are then linked to a modernised wholesale market, which caters to the domestic as well as foreign markets.

As per rough estimates, the average cost of setting up such facilities comes to about Rs. 3,000 per tonne of fruits/vegetables, which means a total investment of about Rs. 30,000 crores 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 congenial policy environment for attracting the same.

(d) Marketing of Horticultural Crops

Organised marketing of fruits and vegetables is almost absent. Consequently, fluctuation in daily prices and a large margin between the wholesale and 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 strong infrastructure, the farmers are least exploited and distribution

is quite widespread, despite high degree of perishability of the fruits. Similar experiences are available with onion and mango in Maharashtra, apple in Himachal Pradesh marketed by the Himachal Pradesh Marketing Corporation, sapota in Gujarat, etc.

India has about 4,000 regulated markets of fruits and vegetables, most of these are in urban and semi-urban areas, using almost primitive methods. These function under the agencies of the Agricultural Produce Marketing Act (APMC) of the individual states. Any attempt to introduce organised marketing using modernised systems at the wholesale levels will have to be done under the purview of the Act in the face of stiff opposition of the vested interests. Fruits (60 to 90 per cent) are generally marketed through pre-harvest contracts, while (70 to 98 per cent) vegetables are mostly disposed off through commission agents (Subrahmanyam, 1983). 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/co-operatives, or production is taken up under a contract farming system, which is gradually becoming popular, particularly for exports and processing. At present, there are 12 state/central level co-operative societies and 275 primary marketing societies directly engaged in this activity, handling only 4 to 5 per cent of the total production. The turnover of these co-operatives amounted to Rs. 362.10 crores, Rs. 437.90 crores and Rs. 471.60 crores in three-year period of 1993-95. There is no exclusive federation of fruits and vegetable co-operatives at the national level for marketing of horticulture produce. This work is being undertaken by the National Agricultural Co-operative Marketing Federation of India (NAFED) in collaboration with state federation and primary marketing societies.

Contract farming carries several advantages such as assured supplies, quality production, higher productivity through faster adoption of new technologies, and above all assured returns to the producer. The Pepsi model was the first major enterprise built on this concept. Several other units, such as Kisans and Nijjer, have since come up. M/s Reitzel India Limited is involved in contract farming of gherkins and cucumber. This practice can gain wide acceptance if certain constraints are overcome in right earnest. These include legal back support for enforcing contracts and speedy redressal of disputes, an effective crop insurance scheme, short-term financing, etc.

(e) 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 like Brazil and U.S.A. with 70 per cent utilisation, Philippines (78 per cent), Malaysia (83 per cent) and Thailand (30 per cent). Although the total installed capacity as in 1993 was about 12.6 lakh tonnes of processed products, the production was only about 5.6 lakh tonnes. Of the various products produced, fruit juices and fruit pulp account for 27 per cent, followed by ready-to-serve beverages and pickles accounting for 12 to 13 per cent each, jams and jelly (10 per cent), and synthetics (8 per cent). The other products produced 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.

India's export of processed fruits and vegetables has increased from Rs. 12.12 crores in value in 1983-84 to over Rs. 491 crores in 1995-96, showing an overall increase of 3,991 per cent in the last 12 years. However, this represents a meagre 0.4 per cent of the total Indian exports. The share of dried and preserved vegetables was largest (over 40 per cent), followed by mango pulp, pickles and chutneys. Major consumers of our products are Gulf countries, U.S.A., U.K., Germany, and Russia. Of these, the Gulf countries accounted for 37 per cent of the total Indian exports, followed by Europe (28 per cent).

Despite a large production base, the availability of raw material to the industry continues to be a major constraint. This has a strong relationship with the per capita production of these commodities and our share in the world exports of processed fruits and vegetables. In the countries whose share in the world trade of processed fruits exceeded 3 per cent, the per capita production of fruits was 3 to 12 times that of India. Similarly, for countries whose share in the world export of processed vegetables exceeded 2 per cent, the per capita vegetable production was 2 to 5 times that of India. For instance, the per capita production of fruits in 1990 in India was only 0.03 tonne while for Israel it was the highest (0.35 tonne), followed by New Zealand, Brazil, Argentina, Chile, Turkey, Australia, etc., in the range of 0.15 to 0.28 tonne. In all these countries, the utilisation of fruits and vegetables for processing is much higher than ours, and their share in the world's export is also equally high as compared to India.

The quality of the material 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 physico-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 one tonne of concentrate, as against only 8 tonnes of Philippine pineapple. Similarly, 7 tonnes of Indian tomato will produce about one 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 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 2 to 4 times higher than those prevailing in international markets in respect of tomato, pineapple and oranges.

(f) *Data Base*

Despite the fact that the total annual production of horticultural crops is around 130-140 million tonnes as compared to over 190 million tonnes of foodgrain crops, the support for collection of statistical data on area and production of these crops is quite inadequate. The Directorate of Economics and Statistics (DE&S) at the central and state level handles only a few horticultural crops, viz., banana, papaya, potato, onion, garlic, coconut, black pepper, chilli, turmeric and cardamom, thus providing incomplete data base which adversely affects proper planning for development and investment in this sector. The only source presently available is the National Horticulture Board (NHB), which collects the data from the State Directorates of Horticulture, compiles the same and publishes it at least two years behind

the schedule. The data are, however, not authentic, as its source is not the revenue records of the village, but the figures collected by the District Horticulture Officers based on the area expansion done under different crops.

Demand Projections

The demand for fruits and vegetables has been worked out on the basis of recommended dietary allowance (RDA) of ICMR, which lays down a minimum per capita consumption of 90 grams of fruits and 280 grams of vegetables including tubers. The demand has also taken into account the requirement of the processing industry and for export. Accordingly, we will need about 60 million tonnes of fruits and 131 million tonnes of vegetables by 2002 to meet the requirements of population of over one billion. About 4.5 lakh tonnes of mushrooms are projected, with major share for processing industry. The demand for cashew, on the other hand, has been based on the rate of growth of domestic consumption and export which would be over 13 per cent per annum, which will in turn mean demand for 8 lakh tonnes of raw nuts by 2002. This will provide the required raw material for the installed processing capacity in the country. As far as coconut is concerned, it is expected that apart from copra making and domestic use as tender nuts, the demand is likely to increase substantially with the intervention of the industry for making different edible products. As such, the demand of the raw coconut would be around 24,000 million nuts by 2002. For other plantation crops like arecanut and cocoa, the demand has been arrived on the basis of increasing domestic consumption and favourable environment available for export. Accordingly, the demand by 2000 is likely to be over 44 lakh tonnes comprising primarily black pepper, chillies, ginger, turmeric, small and large cardamom, etc.

It is now to be analysed as to whether this demand can be fulfilled in the coming five years. Looking at the constraints prevailing, long gestation period of perennial crops, 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. For instance, in the 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. Similarly, in cashew as against 4.5 lakh tonnes of raw cashewnut expected by 1996-97, accounting for 8 per cent annual increase in growth, we expect a total production of 7 lakh tonnes by the year 2002, anticipating a growth rate of 11 per cent. The shortage in meeting the demand would be of one lakh tonnes and will have to be met through imports. As against these commodities, the potential for coconut are bright and the demand of 24,000 million nuts should be possible to achieve, while in spices, the production expected by 2002 would be around 40 lakh tonnes, thus falling slightly short of the demand. Taking these projections, it is estimated that the total demand for the horticultural crops by the end of 2002 (Ninth Plan) would be about 212 million tonnes, while the supply is expected to be 184 million tonnes (Table 7). While some of the shortfalls will be met through imports (e.g., cashew, spices), consistent effort on raising productivity and reducing post-harvest losses are required to make the country self-sufficient in these crops.

TABLE 7. DEMAND PROJECTION AND TARGETS FOR 2002

Commodity (1)	(area in lakh ha; production in lakh tonnes)			
	Demand projection for 2002		Target for 2002	
	Area (2)	Production (3)	Area (4)	Production (5)
Fruits	52.37	594.70	49.33	560.00
Vegetables	69.61	1,312.00	57.32	1,080.00
Spices	29.40	44.30	26.00	39.00
Coconut	26.70	156.00* (24,000 mil- lion nuts)	25.68	150.00
Cashew	6.87	8.00	6.03	7.00
Areca nut	2.45	3.90	2.45	3.90
Total	187.40	2,118.90	166.81	1,839.90

Source: Report of Working Group on Horticulture for Ninth Plan, Planning Commission, Government of India, New Delhi.

STRATEGIES FOR THE FUTURE

The strategy for meeting the targets would primarily involve the existing plantations, in which efforts to improve their productivity would continue with more vigour and input of advanced technology. Going by the current data (1994-95), the average productivity of all horticultural crops put together works out to slightly less than 9 tonnes per hectare. Our efforts should aim at least increasing it by half-a-tonne per hectare per year on an average to provide additional 35 million tonnes by 2002. Added to this will be the production expected from the newly planted areas as a part of crop diversification campaign. Some of the states have made ambitious programmes in this respect and are expected to convert a large hectareage presently under dryland agriculture into horticulture estates. We envisage at least 13 per cent of the area to be diverted in the dryland/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 horticultural plantations which will add at least 3 million hectares to the area under these crops. Diversion of land in irrigated areas would, however, be very limited mainly in favour of high-value crops, viz., floriculture, vegetables, strawberry, etc. In other words, expansion in the area under horticultural crops would in no way be at the cost of area under foodgrain crops or the inputs, which are presently being used for these crops. The apprehension which has been voiced in the past is, therefore, not valid, and should be dispelled once and for all.

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