CHAPTER FOUR
HORTICULTURE: AN OVERVIEW

4.1. Introduction

India has been bestowed with wide range of climate and physio-geographical conditions and as such is most suitable for growing various kinds of horticultural crops such as fruits, vegetables, flowers, nuts, spices and plantation crops (coco nut, cashew nut and cocoa). That is why India has emerged as one of the major producer of fruits and vegetables in the world. Contribution of horticulture sector of the Gross Domestic Product (GDP) is increasing every year.

With the focused attention given to horticulture, there has been spectacular change in terms of adoption of new technologies, production and availability of horticulture product. India today is the second largest producer of fruits and vegetables in the world, contributing 11.84% and 13.36% of the total world production of fruits and vegetables respectively. The availability of flowers has increased significantly in all major cities in the country. India has a good opportunity of growing medicinal and aromatic plants. It is the largest producer, consumer and exporter of spices. India is also the largest producer of coco nut, areca nut and cashew nut in the world.

Keeping in view the importance of horticulture sector, the Government of India has launched a centrally sponsored scheme called the National Horticulture Mission (NHM) in 2005-06. The objectives of the Mission are to enhance horticulture production and improve nutritional security and income support to farm households and others through area based regionally differentiated strategies. Crops such as fruits, spices, flowers, medicinal and aromatic plants, plantation crops of cashew and cocoa are included for area
expansion whereas vegetables are covered through seed production cultivation, integrated nutrient management, integrated pest management and organic farming.

All the states and the three Union Territories of Andaman and Nicobar islands, Lakshadweep and Puducherry are covered under the mission except the 8 North Eastern states including Sikkim and the States of Jammu & Kashmir, Himachal Pradesh and Uttarakhand. The latter are covered under the Horticulture Mission for the North East and Himalayan States. The scheme is being implemented in 372 districts in the country. During 2005-06 to 2009-10 an additional 16.57 lakh hectare of identified horticultural crops have been covered. Apart from establishments of 2192 Nurseries for production of quality planting material 2.78 lakh hectare has been covered under rejuvenation of old orchard.

With the implementation of NHM and other schemes the productions of horticultural crops have increased from 170.8 million tons in 2004-05 to 214.7 million tons in 2008-09. The per capita availability of fruits and vegetables has increased from 391 gram per day in 2004-05 to 466 gram per day in 2008-09. Technology Mission for Integrated development of horticulture in North Eastern states, Sikkim, J&K, Himachal Pradesh and Jharkhand This scheme has launched in 2001-02 to address issues related to production and productivity, marketing and processing of horticultural crops in the North Eastern states. In 2003-04, the Mission was extended to 3 Himalayan states of Himachal Pradesh, Jammu & Kashmir and Uttarakhand. This scheme has now been renamed as Horticulture Mission for North Eastern and Himalayan states. Under these Mission 265435 persons including 53276 women have been trained so far. Horticulture plays a pivotal role in the food and livelihood security of India. Though horticultural crops occupy only 8.5% of arable land, they contribute 24.5% of the GDP in

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agriculture. Plantation crops (tea, coffee and rubber) occupying 0.95% of cropped area have stake of 15.1% of the total export earnings. Economists view that commercialization of agriculture and promotion of agri-business in India is correlated to the progress in the plantation and horticulture sectors. Horticulture and Plantation sector cover production, post-harvest management, marketing, processing and export of fruits, vegetables, flowers, medicinal and aromatic plants, plantation crops, spices, bamboo, mushroom, apiculture and sericulture. On the total production side, India leads the whole world in fruits and vegetables next to China. India has the potential to be the horticulture heaven and plantation paradise.

The performance in production is laudable, but in value addition, processing and export segments, India’s contribution is not as expected. In spite of having a 10% share in global production of both fruits and vegetables, just 1.8% is processed and our export is a meager 0.4%. The 10th Five Year Plan envisaged growth rate of 8% in horticulture. The 11th Plan initiated a massive National Horticulture Mission with an outlay of Rs. 20,000 cores. The Private sector has come up with massive investments in corporate farming, processing and marketing.

4.2. Definition of Horticulture

Horticulture is defined as that branch of agriculture concerned with intensively cultivated plants that are used by people for food, for medicinal purposes, and for aesthetic gratification. There are two key components of this definition that differentiate horticultural crops from other crops: “intensively cultivated” and “used by people for …”. Therefore, horticultural crops are differentiated from other crops by the level of management employed in their production and by their subsequent use. Horticultural
plants are commonly divided into those that are edible, those that are used for culinary or medicinal purposes, and those that are used for ornamental or aesthetic purposes.

Horticulture is also divided into specializations. The terms used to describe these specializations derive from millennia of common usage and are sometimes at odds with botanical nomenclature. For example, vegetables are described as herbaceous plants of which some portion is eaten raw or cooked during the main part of a meal. Fruits, for horticultural purposes, are described as a plant from which a more or less succulent fruit or closely related botanical structure is commonly eaten as a dessert or snack. By these definitions, plants such as tomato, squash and cucumber are considered vegetables despite the fact that the edible portion is defined botanically as a fruit.

Over the last 60 years, agriculture, including horticulture, has become increasingly reliant on science and technology to maintain profitable production. The scientific study of horticulture is divided into various sub-disciplines. Pomology is defined as that branch of horticulture dealing with fruit and tree nut production. Fruit production includes the so-called tree fruits; such as apple, peach, and orange, and small fruits; such as strawberry, blueberry, and raspberry. Olericulture is defined as that branch of horticulture dealing with the production of vegetables and herbs. Floriculture is that branch of horticulture dealing with the production of field-grown or greenhouse-grown plants for their flowers or showy leaves. Environmental horticulture is that branch of horticulture that deals with the production of plants for ornamental use in constructed environments, both indoors and outdoors.

There are many facets to environmental horticulture. Nursery production involves growing plants under intensive management for use in another location. Nurseries are defined in a variety of ways: a) the type of plant grown, such as fruit tree, turf or
Christmas tree nurseries; b) the function of the nursery, such as production, wholesale, retail, mail-order or landscape nurseries; and c) the production system, such as field-grown or container-grown. Landscape horticulture involves the design, installation, and maintenance of both outdoor and indoor environments. Public horticulture involves the design and maintenance of arboreta, public gardens, parks, and athletic facilities. Horticultural therapy involves the use of horticultural plants to improve the condition of people with physical, intellectual or emotional disabilities. Horticultural therapy also includes the use of plants in hospitals and other medical facilities to ease the pain and suffering of patients. Home horticulture involves the use of horticultural plants as a recreational activity, generally by non-professionals.

As discussed above, specialty crops are plants that are intensively cultivated. There are many plants that are specialty crops when cultivated, but are also collected from wild populations. Wild plants are not considered specialty crops even though they may be used for the same purpose as cultivated plants. This is somewhat common among medicinal herbs and woodland plants. There are a number of native ferns that are collected from wild populations for use in the floral trade. There are also a number of marine plants that are collected from wild populations both for direct consumption and for industrial uses.

4.3. Horticulture in India

India has a wide variety of climate and soil on which a large range of horticultural crops such as, fruits; vegetables, potato and other tropical tuber crops; ornamental, medicinal and aromatic plants; plantation crops; spices, cashew and cocoa are grown. After attaining independence in 1947, major emphasis was laid on achieving self sufficiency in food production. Development of high yielding wheat varieties and high production technologies and their adoption in areas of assured irrigation paved the way towards food
security ushering in green revolution in the sixties. It, however, gradually became clear that horticultural crops for which the Indian topography and agro-climates are well suited is an ideal method of achieving sustainability of small holdings, increasing employment, improving environment, providing an enormous export potential and above all achieving nutritional security. As a result, due emphasis on diversification to horticultural crops was given only during the last one decade.

India is the most suitable for growing various kinds of horticultural crops such as fruits, vegetables, flowers, nuts, spices and plantation crops (coco nut, cashew nut and cocoa). Its horticulture production has increased by 30 per cent in the last five years. This has placed India among the foremost countries in horticulture production, just behind China. During 2010-11, its contribution in the world production of fruits & vegetables was 12% & 14% respectively. Total production of fruits during last year was 599 million tones while that of vegetables was 1012 million tones.

India is the largest producer, consumer and exporter of spices. India is also the largest producer of mango, banana, papaya, coconut, areca nut and cashew nut in the world. India’s significant horticulture production is despite its comparatively lower productivity. Both in case of fruits & vegetables productivity of India (11.7 & 17.3 tons per hectare respectively ) is about half of the productivity of USA( 22.2 and 31.4 tons per hectare). During 2010-11, its productivity was closer to world average for both fruits(10.9) & vegetables(18.8 tons per hectare). Compared to the leading producer of fruits & vegetables China, India lags behind in productivity in case of vegetables, whereas it leads in case of fruits. In fact productivity of India is amongst the highest in case of some fruits like grapes, banana, and papaya.
4.4. Horticulture in West Bengal

West Bengal is located between 21°31’ and 27°14’ N latitude and 85°51’ and 89° E longitudes. It is flanked by the Bay of Bengal in the south, Sikkim on the north, Assam on the east and Jharkhand and Orissa on the west. It covers an area of 8.85 million hectares, representing only 2.7% of the total area of the country. The state is divided into 19 administrative districts, viz. Bankura, Birbhum, Burdwan, Coochbehar, Darjeeling, Hooghly, Howrah, Jalpaiguri, Kolkata, Malda, Midnapore-East, Midnapore-West, Murshidabad, Nadia, North 24 Parganas, North Dinajpur, Purulia, South 24 Parganas, and South Dinajpur.

The economy of West Bengal is well diversified and according to the Economic Review 2009-2010, Government of West Bengal, the importance of agriculture in the state’s economy is reflected by its contribution of around 20% to the total Net State Domestic Product. The employment support from the sector is 62.7% of rural work force, and about 70% are dependent on agriculture for their livelihood. The state produces 7.35% of total food grains in the country. Total cultivable land in the state is 56.07 lakh hectares which is about 64.57% of the total geographical area of the state. West Bengal is the highest producer of vegetables in the country and seventh in the production of fruits.

With a horticulture production of about 30 million tone (13% of total production), West Bengal, led the horticulture production during 2010-11 followed by Andhra Pradesh (10%), Uttar Pradesh (10%) & Tamil Nadu (10%). Uttar Pradesh slipped to third position from the first position in 2009-10 because its production declined by 5 million tons whereas the production of west Bengal, Andhra & Tamil Nadu increased by 5, 4 & 3 million tons respectively. West Bengal alone accounted for more than one third (34%) of total flower production (including both cut & loose flowers) during 2010-11. In fruit
production, Tamil Nadu led in banana production (8 million tons, 28 %), whereas Uttar Pradesh (3.6 million tons, 24 %) & Andhra (22%) contributed significantly in production of mango. Uttar Pradesh (13.6 million tons) and West Bengal (3.4 million tons) each accounted for about one third (32 %) of potato production in the country. Maharashtra led in onion production with produce of about 5 million tons and accounted for about one third (32%) of total onion produced in the country. Production of tomato, however, was more evenly distributed with the highest producer Karnataka (1.7 million tons) accounting for about 10 per cent of overall production.  

The Agri-Horticulture sector in West Bengal holds tremendous potential for larger production, area expansion, generation of self-employment, processing, packaging, transportation and marketing. The state produces a considerable quantity of spices, coconut, cashew nut, medicinal and aromatic plants, mushroom, etc. Amongst fruits- mango, pineapple, litchi, banana, sapota, guava, etc. are important for commercial cultivation, processing and export. The farmers are also producing non-traditional vegetables like baby corn, Brussels sprout, gherkin, broccoli, etc. West Bengal has a significant share of the total mango production in the country.

4.5. Importance and Scope of Horticulture

India with diverse soil and climate comprising several agro-ecological regions provides ample opportunity to grow a variety of horticultural crops. These crops form a significant part of total agricultural produce in the country comprising of fruits, vegetables, root and tuber crops, flowers, ornamental plants, medicinal and aromatic plants, spices, condiments, plantation crops and mushrooms.
It is estimated that nearly 11-6 million hectares of land is covered by horticultural crops and the annual production is about 91 millions tones. Though these crops occupy hardly 7% of the cropped area they contribute over 18% to the gross agricultural output in the country.

Horticultural crops play a unique role in our state economy by improving the income of the rural people. Cultivation of these crops is labour intensive and as such they generate lot of employment opportunities for the rural population. Fruits and vegetables are also rich source of vitamins, minerals, proteins, and carbohydrates etc. which are essential in human nutrition. Hence, these are referred to as protective foods and assumed great importance as nutritional security of the people. Thus, cultivation of horticultural crops plays a vital role in the prosperity of a nation and is directly linked with the health and happiness of the people.

Fruits and vegetables are not only used for domestic consumption and processing into various products (pickles, preserves sauces, jam, and jelly squash) but also substantial quantities are exported in fresh and processed form, bringing much-needed foreign exchange for the country. These groups of crops also provide ample scope for achieving bio-diversity and diversification to maintain ecological balance and to create sustainable agriculture and can make an impact on the national economy in the years to come.

Horticultural crops are not only important components of a balanced diet but their development for high value markets is seen as an important engine of growth for economic development.

The recent emphasis on horticulture in our country consequent to the recognition of the need for attaining nutrition security and for more profitable land use has brought about a significant change in the outlook of the growers. The need for great utilization of
available wastelands against the background of dwindling water and energy resources has focused attention to dry land, to arid and semi-arid tracts and to horticultural crops which have lesser demands on water and other inputs besides being 3 to 4 times more remunerative than field crops.

4.6. Horticultural Research in India

The horticulture scenario of the country is rapidly changing. The production and productivity of horticultural crops have increased manifold. Production of fruits and vegetables has tripled in the last 50 years. The productivity has gone up by three times in banana and by 2.5 times in potato. Today horticultural crops cover about 25 per cent of total agricultural exports of the country. The corporate sector is also showing greater interest in horticulture. A major shift in consumption pattern of fresh and processed fruits and vegetables is expected in the coming century. There will be greater technology adoption both in traditional horticultural enterprise as well as in commercial horticulture sectors. Diversification and value addition will be the key words in the Indian horticulture in the 21st Century.

Horticultural research in India is about four decades old. Systematic research on fruit, vegetable and ornamental crops began in 1954 with the initiation of independent institutions and programmes. The research agenda is designed relevant to national plans and priorities for the horticulture development. Today, eight ICAR institutes with 27 regional stations, 1 project directorate, 10 national research centres, 16 all India coordinated research projects (AICRPS) with 223 research stations, 1 full-fledged university of horticulture, 25 state agricultural universities and 7 multi-disciplinary institutes of the ICAR are engaged in horticultural research. In addition, a few R&D establishments of crop/commodity boards and private sectors are providing research
support to Indian horticulture. Research system in horticulture is now geared to provide necessary technological support to the expanding horticultural industry\textsuperscript{10}.

**4.6.1. Research Infrastructure**

The Indian Council of Agricultural Research is the premier agency which pioneered systematic research on agricultural crops in the country. Horticulture research in India received very little attention till the 3\textsuperscript{rd} Five Year Plan. The establishment of the Indian Institute of Horticultural Research at Bangalore and starting of eight All India Coordinated Crop Improvement Projects to cover different horticultural crops was a landmark in the history of horticulture in 4\textsuperscript{th} Five Year Plan (1969-74). Rapid expansion of infrastructure took place in 7\textsuperscript{th} and 8\textsuperscript{th} Plans. Today, the horticultural research in the country is being carried out at eight ICAR institutes (with 26 regional stations), 10 National Research Centres (on major crops) and a Project Directorate on Vegetable crops. Area specific, multi-disciplinary research is also being conducted under 14 All India Coordinated Research Projects each on Tropical, Subtropical and Arid Fruits; Vegetables, Potato, Tuber Crops and Mushrooms; Ornamental Crops, Medicinal and Aromatic crops; Palms, Cashew, Spices and Betel vine; and Post Harvest Technology at 215 centres located at various research Institutes, and State Agricultural Universities. In addition, four net work projects each on hybrid research in vegetable crops, drip, irrigation in perennial horticultural crops, protected cultivation of ornamental crops and \textit{Phytophthora} diseases of horticulture crops are now in operation. Research on horticulture is also being undertaken at several multi-crop, multi-disciplinary Institutes. Departments of Horticulture in 24 Agricultural Universities, one deemed to be University and one full fledged University of Horticulture and Forestry are also engaged in horticultural research. Besides 280 adhoc schemes supported from Agriculture Produce Cess Fund and a number
of foreign-aided projects have also been in operation on specific problems of different horticulture crops. As a result, the country now has a sound research infrastructure in horticulture to meet the growing needs and expectations of the fast developing horticulture industry.\(^\text{11}\)

### 4.6.2. Organization of Horticultural Research

Horticultural research in India is hardly four decades old. The institutions involved in horticultural research and their roles are:

**4.6.2.1. At National Level**

Central Research Institutes (CRI), Project Directorate (PD) and National Research Centres (NRC) set up by the Indian Council of Agricultural Research (ICAR) are engaged mainly in:

- Basic and applied research for developing strategies to enhance productivity and utilization of horticultural crops;
- Act as repository of scientific information relevant to horticulture;
- Provide training of scientific and technical manpower in horticulture and
- To provide consultancy to promote horticulture development.

Today 8 CRIs with 27 Regional Stations, 1 PD and 10 NRCs are operational directly under the administrative control of the Horticulture Division of the ICAR. In addition, 7 multi-disciplinary institutions of ICAR are also engaged in horticultural research.

The ICAR has also launched a good number of network projects named as ALL India Co-ordinate Research Projects (AICRPs) on different horticultural crops. The cardinal feature
of the AICRP is its operation on a country wide basis under the direct supervision and on a country wide basis under the direct supervision and technical guidance of the ICAR. Each Co-ordinate project is headed by a Project Co-ordinate (PC) appointed by the ICAR and under such projects both the CRIs / NRCs of the ICAR and the State Agricultural Universities (SAUs) work as teams to find solutions to certain specific problems. Today there are 15 AICRPs on different horticultural crops, operational at 215 research centres all throughout the country.\textsuperscript{12}

The Agri Horticultural Society of India\textsuperscript{13} was founded in 1820 by William Carey on the Alipore Road, Kolkata. It has a flower garden, greenhouses, a research laboratory and a library. It houses a massive collection of plants and flowers. It has a significant collection of botanical varieties, including Cannas for which it has a long and distinguished tradition, with facilities for gardeners and plant/flower lovers. Courses on gardening and cultivation of certain species are offered to the general public from time to time. A large variety of ferns and medicinal plants are grown in the Society's gardens. Thousands of fruits and flowers are grown and may also be bought at the nursery. It organizes annual flower shows in winter and imparts training in horticulture which is a major seasonal attraction. In 1894 Mr. Percy Lancaster was appointed Secretary to the Society, and founded the famous Alipore Canna Collection. His work was carried on by his son, Mr. Sydney Percy-Lancaster until his retirement in the 1960s.

National Horticulture Mission\textsuperscript{14} (NHM) is an Indian horticulture Scheme promoted by Government of India. It was launched under the 10th five-year plan in the year 2005-06. The NHM's key objective is to develop horticulture to the maximum potential available in the state and to augment production of all horticultural products (fruits,
vegetables, flowers, plantation crops, spices, medicinal aromatic plants) in the state. Other objectives are as under:

- To provide holistic growth of the horticulture sector through an area based regionally differentiated strategies
- To enhance horticulture production, improve nutritional security and income support to farm households
- To establish convergence and synergy among multiple on-going and planned programmes for horticulture development
- To promote, develop and disseminate technologies, through a seamless blend of traditional wisdom and modern scientific knowledge
- To create opportunities for employment generation for skilled and unskilled persons, especially unemployed youth.

National Horticulture Board\textsuperscript{15} (NHB) was set up by the Government of India in 1984 as an autonomous society under the Societies Registration Act 1860. Board has its Head Quarter in Institutional Area, Sector 18, Gurgaon (Haryana). The Managing Director is the Principal executive of NHB as well as the Department of Agriculture & Co-operation, Ministry of Agriculture, Government of India.

The broad aims & objectives of all the above mentioned schemes are as under:

- Development of hi-tech commercial horticulture in identified belts;
- Development of modern post-harvest management infrastructure as integral part of area expansion projects or as common facility for cluster of projects;
➢ Development of integrated, energy efficient cold chain infrastructure for fresh horticulture produce;

➢ Popularization of identified new technologies / tools / techniques for commercialization / adoption, after carrying out technology need assessment;

➢ Assistance in searing availability of quality planting material by promoting setting up of scion and root stock banks / mother plant nurseries, carrying out accreditation / rating of horticulture nurseries and need based imports of planting material;

➢ Promotion and market development of fresh horticulture produce;

➢ Promotion of applied R & D for standardizing PHM protocols, prescribing critical storage conditions for fresh horticulture produce, bench marking of technical standards for cold chain infrastructure etc.,

➢ Transfer of technology to producers/farmers and service providers such as gardeners, farm level skilled workers, operators in cold storages, work force carrying out post harvest management including processing of fresh horticulture produce, and to the master trainers;

➢ Promotion of consumption of horticulture produce and products;

➢ Setting up Common Facility Centers in Horticulture Parks and Agri-Export Zones;

➢ Strengthen market intelligence system by developing, collecting and disseminating horticulture database;

The aims and objectives of the Society are

\begin{itemize}
  \item To cultivate and promote research, education and development of horticulture and allied branches of science.
  \item To recognize and support excellence achieved in scientific research and development in the field of horticulture by individual scientists, interdisciplinary teams, recognized institutions, learned societies and industry.
  \item To promote contact and co-operation among R & D personnel working in different institutions and areas (including growers and industry).
  \item To regularly bring out the Indian Journal of Horticulture and any other publication decided by the Society.
  \item To disseminate knowledge on all horticultural crops and their different aspects by holding seminars, symposia, conferences, discussions etc. and publishing their proceedings.
  \item To secure and manage funds and endowments for the promotion of horticulture in all its aspects.
  \item To undertake other activities relevant to accomplish the above objectives.
\end{itemize}
4.6.2.2. At State Level

Regional research is primarily being undertaken by the State Agricultural Universities. One full fledged university on horticulture in the Himalayan State of Himachal Pradesh and 46 SAUs with large number of research stations in 17 major states of the country are presently implementing applied research and generating location specific technology for various horticultural crops.

In addition, traditional universities, and other central organizations like the Council of Scientific and Industrial Research, Department of Biotechnology, Atomic Energy Research Centre and others also undertake horticultural research projects in basic area such as biotechnology. For funding solutions to specific and identified problems, ICAR provides funding support to non-ICAR institutions through large number of time bound ad-hoc projects. International collaboration and certain foreign aided projects also promoted horticultural research in the countries in certain specific areas17.

Various Institutes like Indian Agricultural Research Institute (IARI), horticulture wing in Indian Council of Agricultural Research (ICAR), Indian Institute for Horticulture Research, Bangalore; 47 State Agricultural Universities have been continuously striving to improve the quality of the horticultural products as well as to increase their productivity.

4.7 Conclusion

India has a good natural resource base, an adequate R&D infrastructure and excellence in several areas. As a result, the horticultural scenario of the country has been changing fast. Both production and productivity of several crops has increased manifold and India can boast itself as a leading horticultural country of the world. Many new crops have been
introduced and many others have adapted to non conventional areas. Some other crops are under adaptive trials. A number of turn key projects in mushrooms and flower production have been established. Near self-sufficiency has been achieved in many crops. Export of fresh as well as processed fruits has been increasing. The demand of horticulture produce is on the rise due to increasing population, changing food habits, realization of high nutritional value of horticultural crops and greater emphasis on value addition and export. However, several challenges are yet to be met. These are, fast eroding gene pool, fast population build up, shrinking land and other natural resources, serious production constraints, both biotic and huge post harvest losses. Further, in the era of globalization, produce has to be of international quality and globally competitive. The future expansion of horticulture has to be in and semiarid areas and on underutilized crops.

While the impact of green revolution in India was felt mainly in assured irrigation areas, horticultural crop production has brought prosperity even in and semiarid areas. Horticulture is no longer a leisurely avocation and is fast assuming position of a vibrant commercial venture. Nature has placed India in a state of advantage and it is now on us horticultural scientists to work towards ushering in a golden revolution in years to come in India.
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CHAPTER FIVE
THE CONCEPT OF BIBLIOMETRICS

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