J. Hortl. Sci.
Vol. 6(1):76-83, 2011

Short communication

Market information system for horticultural crops: Web application development for interactive graphs

M.K. Chandra Prakash, Reena Rosy Thomas[1], Sudha Mysore, G. Vadivel and Rasika Thaker
Section of Economics and Statistics
Indian Institute of Horticultural Research
Hessaraghatta Lake Post, Bangalore - 560 089, India
Email: mk_chandraprakash@yahoo.com

ABSTRACT

Marketing information service has been recognized as key for success in marketing of perishable commodities. Effort has been made to improve access to market information to all stakeholders involved in marketing of horticultural crops. Current study is an attempt in this direction to review various modes of such information support and also to highlight the effort made by premier institution like Indian Institute of Horticultural Research.

Web application has been developed for Market information to display the data as Interactive graphs. Data for the study includes the month-wise arrival and price information of different horticultural commodities from different markets for a period of ten years. This is collected from primary sources such as District -wise, Marketwise and secondary sources such as NHB, NHRDF etc., the data were tabulated and uploaded to Microsoft SQL server database through customized CMS module. Further, the price arrival data has been translated to the Interactive Charts by programs developed using Microsoft Visual studio. NET technologies, which is a relatively new addition to IIHR website.

Interactive Charts are used for drilling down for more information on price and arrivals. It consists of several interactive components like zoom, compare etc. Zoom component of the chart enables the user to zoom the graph to read the price trend prevailed in market in detail, which cannot be possible on Basic Chart. The Compare option allows user to compare price data with several other markets. The farmers and traders will get the advantage of taking precise decisions regarding choice of time and place for sale of their produce using this information system. Further, lean, peak stabilization periods prevailing in various markets enable farmers to schedule the cultivation plans.

Key words: Horticulture, Competitiveness, Comparative Advantage, Interactive chart, price, arrival and markets

Horticulture crop sector comprising of fruits, vegetables, ornamental and medicinal plants, mushrooms and plantation crops has emerged as a key sector of Indian economy in the recent past. With two-fold increase in area coupled with four-fold increase in production, fruits and vegetables have shown that these could add value not only to the nutritional security but also to the income and employment security of rural population. However, increased production of horticultural produce has resulted in increased marketable surplus and hence resulted in increased market arrivals and associated market lead risks. Horticultural crops, especially fruits, vegetables and flowers being highly seasonal and perishable, pose difficulties in their disposal and often lead to frequent market gluts and associated distress sale for producers.

Realizing the need to provide access to markets and to help producers for higher share in consumers' rupee, efforts have been made to create requisite market infrastructure closer to production centres. Effort has also been on to improve access to market information to all stakeholders involved in marketing of horticultural crops. Day to day price fluctuations for some of the vegetables like tomato are so steep that often makes it uneconomical for producers even to harvest the produce. While much has been accomplished in augmenting the production risks in case of horticultural crops through improved technologies and other package of practices, marketing is still in the hands of few exploitative traders and middlemen. In a market network, flow of physical goods is in the forward direction, while the flow of money and information is in opposite

[1]Project Co-ordinator (Tropical Fruits) Cell, IIHR, Bangalore

direction. A typical marketing network of horticultural crops is thus dominated by pre-harvest contractors and commission agents, who not only assist the marketing process through assembling and forwarding, but also hold key information about the arrivals and price movements there by managing a hold on the entire marketing transaction. The marketing networks of horticultural crops are long with a number of market intermediaries, each adding cost and claiming margin, there by reducing the producers share in final consumers' rupee. Access to market information, often referred to as market intelligence or marketing information service, has been recognized as the key for success in marketing of perishable commodities.

The data for this study was collected from different markets for a period of ten years (1993-94 to 2006-07) from primary and secondary sources including NHB, NHRDF besides primary market centres. The month wise arrival and price data, thus collected were then uploaded to MS SQL database through customized Content Management module, in market-wise, month-wise and crop-wise. The advantage of MS SQL server database is it can accommodate millions of records and easily be retrieved. The SQL stored procedures are embedded in website's Market Information System module, which enables the data retrieval as text and graph as well, using Component Art software.

Market information - Graphical display, primarily uses two major files, one for forms and objects and other for program codes. Program modules were developed using Microsoft Visual Studio.NET's **C#** (C Sharp) programming language. In appropriate location, Component Art modules were also called as sub-program to enable the graphical display. Database connection has been established using data bind modules, while label style and high speed rendering for graph display were developed using Component Art's label style and Geometric Engine, respectively.

Similarly for Drawing graph, comparing graphs Zooming a graph, table view for predefined periods separate modules were developed and embedded in appropriate controls to execute the same. The entire graph in this module has been used with two dimensional projection systems

Component Art - Charting software has been used for developing the Market Information System (MIS). It is a comprehensive set of charting components designed to deliver highly interactive visualization of business data, featuring brilliant rendering, interactive drill-downs, with built-in zooming & scrolling. The software is also equipped to handle extremely large datasets and integration with the powerful CalcEngine data processing control.

Bar & Column Charts has been used for plotting discrete (or 'discontinuous') data, providing an effective visualization for a sequence of values. Bar charts are displayed in horizontal orientation for depicting into various markets, while columns or line graphs in vertical orientation for price movement.

Line Charts have been used to capture the trends in data over different time intervals; for the nature of the pattern being followed line graphs are appropriate. Extensive design-time capabilities of the software are programmed within Microsoft's Visual Studio IDE. All controls include custom design UI panels, enables quick customization and design-time preview.

Programmes have been developed to support Embedded Visualizations and GridView's data panel, and dynamic visualizations of tabular data. By utilizing virtualized rendering, GridView maintains optimal performance as its data set grows. Scroll through tens of thousands of rows, and sort or group them, without compromising the usability of the application. The software had the ability to Handle Very Large Datasets.

The Charting controls has been leveraged to handle extremely large amounts of data – measured in millions of records – through a highly effective WCF web service communication layer. In addition, all controls are capable of handling tens of thousands of records of SQL database.

Status and efforts so far into market Information systems

Access to markets by the producers has been well recognized. In view of the prevailing malpractices in agricultural markets, a task force has been set up to bring about market reforms. As a result of concerted efforts agricultural/horticultural crops have witnessed several market reforms. These include the establishment of markets close to production areas, infrastructure, proper weighment and other facilities at the markets have been accomplished. Market regulation has also been enforced at different markets. Besides these, the need to impart access to market information has been felt especially in case of horticultural commodities.

The impact of IT on the agricultural supply chain has largely been ignored in the information systems empirical literature. Initiatives have the potential to affect the lives of billions of people that live on the other side of the digital divide, their effectiveness is often unclear and many are skeptical that the benefits actually reach the rural communities; The other potential area is policy formulation, such as the nature and magnitude of the benefits from online platforms (Banker and Mitra, 2005). The general price level of an agricultural commodity, whether at a major terminal, port, or commodity futures exchange, is influenced by a variety of market forces that can alter the current or expected balance between supply and demand. (Randy Schnepf, 2006).

In the recent past, Ministry of Agriculture and several State governments started providing the arrival and price details for different agricultural commodities on line for access by different stakeholders much of this information could be made as practical value for the producers.

The portal *www.agmarknet.nic.in* which belongs to Directorate of Marketing & Inspection (DMI), Ministry of Agriculture, Government of India provides easy access to commodity-wise, variety-wise daily prices and arrivals information in respect of various wholesale markets spread across the country. Prices and arrivals trend reports for important commodities are also published regularly. Besides, future prices from National Multi-Commodity Exchange of India Ltd *www.nmce.com* are being reflected online on the portal. Linkages are available for Food and Agriculture Organization (FAO) http://*www.fao.org* and Asian & Pacific Coconut Community (APCC) http://*www.apccsec.org* for accessing international commodity price trends.

The arrival and prices of different agricultural commodities as received from the Agricultural Produce Market Committee (APMCs) of different States are uploaded at *AGMARKNET* portal for information. The market information on the portal is as reported by the respective markets. The portal is designed, developed and maintained by National Informatics Centre, contents provided by Directorate of Marketing & Inspection (DMI), Ministry of Agriculture.

STATE AGRICULTURAL MARKETING BOARDS / DIRECTORATES

Agriculture being a state subject, Development of the Agricultural Marketing System in the respective states is primarily being taken care by the State Agricultural Marketing Boards and Directorates. The activities, schemes and state specific initiative are accessible through the linkages provided to their websites (Madhya Pradesh, Karnataka, Punjab, Orissa, Delhi, Tamil Nadu, Andhra Pradesh, Meghalaya etc).

Karnataka State Agricultural Marketing Department/ Board: *www.maratavahini.kar.nic.in,* its objective is to co-ordinate functioning of all the market committees with the help of information service obtained by both National and International markets

The Rajasthan State Agricultural Marketing Board (*http://rsamb.rajasthan.gov.in)* has devoted itself to the development of Agricultural Marketing since its inception in 1974. The activities of the Marketing Board are now not limited to construction of market yards-godowns and village link roads, but cover the entire gamut of Post harvest management and Agricultural Marketing developmental activities in the wake of the liberalization of the economic policy of the country. The Rajasthan State Agricultural Marketing Board has taken up the task to export main commodities of the State to other countries with an object to not only boost up production and Productivity but also quality of Agro produce in the State.

The Government of Meghalaya has set up two secondary regulated markets in the State *http:// megamb.gov.in.* The first one was set up in Mawiong in East Khasi Hills District and the second at Garobadha, West Garo Hills District. Moreover, there are daily markets in Shillong (Iewduh), Jowai, Tura, Williamnagar etc. Farmers can bring their agricultural produce to Regulated Market (APMC) to get remunerative prices. Free temporary storage of the farmers' unsold produce may be provided in the market yard till the farmer gets a favourable price in order to prevent distress sales.

Madhya Pradesh State Agricultural Marketing Board *http://www.mpmandiboard.org* provides daily Rates (Rs per Quintal) on Paddy, wheat, Jawar and Maize.

ACADEMIC INSTITUTIONS ON AGRI-CULTURAL MARKETING

Academic institutions and agricultural institutes viz. National Institute of Agricultural Marketing, National Institute of Agricultural Extension Management, Institute of Rural Management etc are imparting training and consultancy on agri-business management, agricultural marketing, co-

operative marketing etc. also provides market related information.

National Institute of Agricultural Marketing *http://www.ccsniam.gov.in* focuses on Agricultural Marketing system in States, Post Harvest Loss Reduction aspects, Information Technology Application in Agricultural Marketing, Future and Forward Markets and Commodity Exchanges Food Safety, Quality Certification & Standardization etc.

The MANAGE (*http://www.manage.gov.in)* vests with the responsibility to develop linkages between state, regional, national and international institutions concerned with agricultural extension management. It also, focuses on agricultural extension management systems and policies, collaborative linkages with national and international institutions.

RELATED MARKETING ORGANIZATIONS IN AGRICULTURAL SECTOR

Market organization viz. NHB, APEDA, NCDC, NAFED and NHRDF also provide information relating to agricultural marketing schemes implemented by Government Departments. Central agencies viz. Commerce, Food and Public Distribution, Food Processing Industries, Consumer Affairs, Health National Dairy Development Board, National Horticulture Board, National Horticultural Research and Development Foundation, Coconut Development Board, Agricultural Processed Food Products Development Authority, Marine Products Exports Development Authority etc also provide data for effective marketing.

National Horticulture Board (NHB) (*http://nhb.gov.in)* The National Horticultural Board (NHB) ever since its inception has been publishing the market arrivals and prices for different commodities for important markets across the country. The NHB also started faxing this data on request to different organizations as and when required. Its role to strengthen market intelligence system by developing, collecting and disseminating horticulture database, It provides Price and Arrival Statistics. Daily arrivals and prevailing minimum, maximum and nodal price data have been compiled for different horticultural commodities at different market yards. The market committees also record the daily information, compile into weekly and monthly data and compile the same for the district as a whole and publish it periodically.

The Agricultural and Processed Food Products Export Development Authority (APEDA): *(http://www.apeda.gov.in)* was established by the Government of India under the Agricultural and Processed Food Products Export Development Authority with objective for Improving of marketing of the Scheduled products outside India, promotion of export oriented production and development of the Scheduled products viz., Fruits, Vegetables and their Products, Meat and Meat Products, Poultry and Poultry Products, Dairy Products, Confectionery, Biscuits and Bakery Products, Honey and Sugar Products, Cocoa and its products Cereal and Cereal Products Floriculture and Floriculture Products APEDA is also mandated with the responsibility of Collection of statistics from the owners of factories or establishments engaged in the production, processing, packaging and marketing.

The National Cooperative Development Corporation (NCDC) *(http://www.ncdc.in)* supports fruit and vegetable marketing and processing cooperatives. It is a unique organization, which not only plays a developmental role but also provides financial assistance for creating infrastructure for marketing, processing and storage of agricultural produce in the Cooperative Sector.

National Agricultural Cooperative Marketing Federation of India Ltd (NAFED) (*http://www.nafed-india.com)*: The objectives of the NAFED shall be to organize, promote and develop marketing, processing and storage of agricultural, horticultural and forest produce, distribution of agricultural machinery, implements and other inputs, undertake inter-State, import and export trade, wholesale or retail as the case may be and to act and assist for technical advice in agricultural production for the promotion and the working of its members and cooperative marketing, processing and supply societies in India.

National Horticultural Research and Development Foundation: (http://www.nhrdf.com**):** This Site contains in-depth Information pertaining to production and post-harvest technology, data on area, production, export, market arrivals, and prices of onion, garlic and potato.

Agriwatch.com: ***(http://www.agriwatch.com)*** is a private enterprise by Indian Agribusiness Systems Pvt. Ltd. (IASL). The agribusiness sector lacks quality of information and analysis about Demand, Supply, Prices, Market Trends for various agri-commodities. The Company primarily aims at filling out the information and communication gap that exists

in various sub-sectors of the Agricultural Economy and Commodities trade in particular.

The Company is making use of the latest developments in information technology. The objective of the Company is to achieve a perfect flow of information, analyses, communication and e-commerce. The Company also provide information for various participants in the Agribusiness sector such as the farmers, Traders, Processors of Agricultural Outputs, Suppliers of Agricultural Inputs etc. It provides analyses to the trade participants that will enhance their decision taking abilities in trade.

The site provides commodity trading trends on various markets on Grains, Pulses, Vegoils, Oilseed, Oil meal, Sugar, Cotton, Spices, Plantation crops. It provides Market Intelligence reports, Spot Market comments etc. It also provides Exchange Quotes viz. Commodity Exchange Packages: Oil Complex, Soy Complex, Vegoils, OilSeeds, Mustard Seed. Individual Exchanges: CBOT, KLCE, NBOT, Hapur, Hissar and External Exchanges Quotes viz. NBOT Delayed, Jakarta Exchange, TOCOM – Tokyo, NYMEX, Cbot Projections (Soy Oil), Cbot Projections (Soy Meal), Cbot Projections (Soy Bean).

Though all the above mentioned database, website, portal provides information, the main drawback is translating such information to knowledge. Even if the producers do have access they may not be able to use this information effectively due to lack of tools to translate the data to meaningful conclusions.

In this context MIS has been developed to translate the data into Interactive graphs, where price movement in markets, arrival and comparison of markets can be viewed as graphical charts where the user absorbs much easily than textual data. The human brain has the ability to easily absorb graphical representation than text.

Market Information System on IIHR website: *http://www.iihr.ernet.in/frmMarketInformation.aspx*

Access methods and highlights: Market Information System (MIS) developed and placed on IIHR website (Fig. 1) is unique in the sense it is a static data set that provides a dynamic access and utility to all users. The information seeker has an option to select the commodity, different periods of time and different markets, which results in a graphic representation of the data set. Below the main graph is zoom component, which when moved highlights the selected portions on graph providing a detailed trend of price movements. The special feature of the MIS is its ability to provide comparative picture of price movement in two selected markets for the selected commodity in a graphic form. Such a representation provides ready and easy comparison for the information seeker. The fact that the data set sought for is also depicted in a table format below the graph itself is an additional advantage of this system. This data set can be selected, copied and pasted and printed as per the requirement of the information seeker.

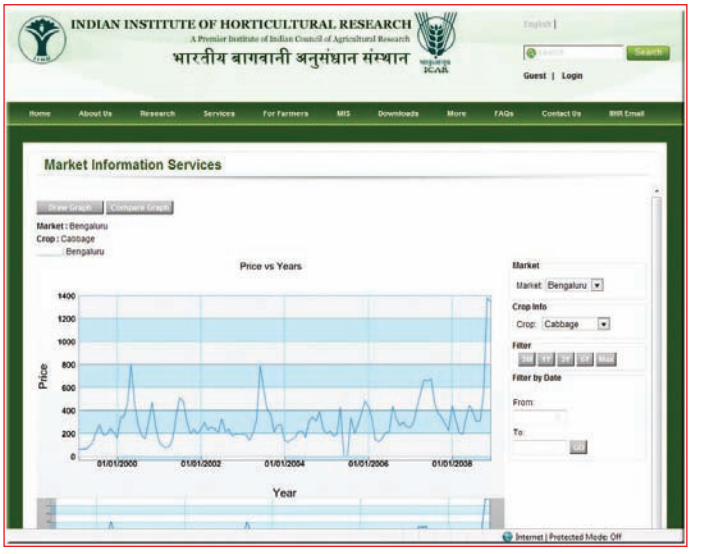

Fig 1. Market Information System on IIHR website: Displays dynamic interactive graphs of price and arrival data for horticultural crops of various markets

The data on area production and productivity of horticultural commodities at district level is a very useful and essential feature for several R& D and other Government and non government organizations and researchers. Such a voluminous data, easily accessible and available as Graph is also first of its kind and has been presented in MIS of IIHR website. Above all, having created the web page, the authors are confident of replicating such access to other commodities and markets as well.

MIS features: The market selection box (Fig. 2) enables the user to choose a market. A similar selection box is provided below for comparing price prevailed at both the markets. By default, the data provided is for ten years. Further to enable the user, choose predefined periods; 1 year, 2 years, 3 years, options are provided. Also, the date range selection box is provided to select the specific periods, to display the data within the range.

The compare options enable the comparison of two markets as line graph. The graphical comparison the enable

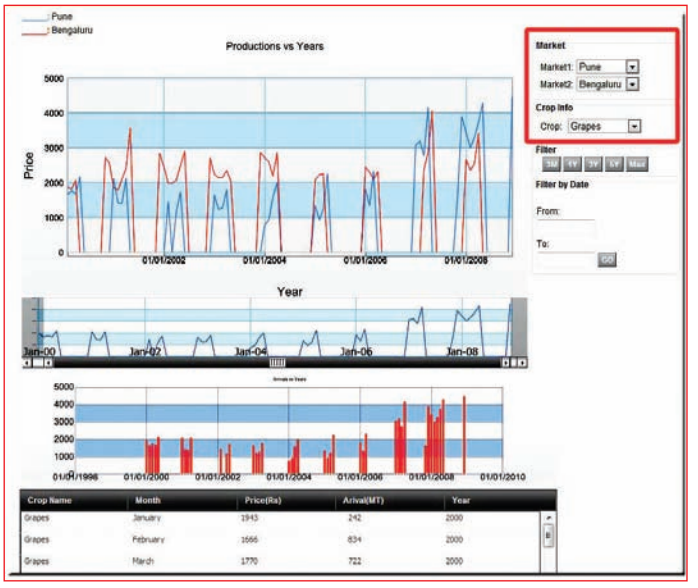

Fig 2. The selection box displayed with red borders enables the user to choose markets to view price and arrival data and compare as well

the user to absorb the relative price difference between markets, this would be advantageous if the markets are accessible with the same logistic cost. The better market with price advantageous could be chosen for disposal of the produce.

For example, Fig. 3 shows a comparison of market prices in Chennai and Bangalore for a selected commodity. Chennai price seems higher than Bangalore market price for most period, but a sudden steep rise is seen in Bangalore

Fig 3. Compare options-Price comparison of two markets Chennai and Bengaluru for the Brinjal crop on clicking compare graph button, displays the price movement in both the markets

price. This could be taken as an arbitrage advantage, as both the markets may be easily accessible for the producers located in the nearby regions and take advantage of the higher prices prevailing in a specific market. Further, the graph also provides the prevailing price trends in different markets for ready reference. Similarly for other crops can also be visualized for the price trend, peaks, lean and stability periods.

Zoom: A zoom component is provided just below the primary graph display region which enables the user to expand and contract the zoom component, (Fig. 4) which in turn zoom the primary graph display area. The users are able to visualize the peaks with much clarity by zooming the date range. The years and prices are displayed in 'x' and 'y' axis, respectively. The peak price could be viewed from y axis. However, the exact data point could be obtained from the text data display box beneath the zoom component, by default, 10 years price is displayed.

Fig. 4. Zoom Component - A zoom object with horizontal scroll bar enables the user to zoom graphical display area by expanding and contracting the zoom object.

Users can expand up to maximum data range and contract to minimum of few months. The zoom object could be moved horizontally across the 10 years to view price data of specific year too. By zooming in and out the large set of SQL data translated to dynamic graph during run time, thus the user view the graph with out date range input.

Grid view: The Grid view data panel displays tabular data that consist of crop name, month, price arrival and year. The advantage of this table view is that the data points

Fig. 5. Grid view data panel displays the exact text data of onion crop of Bengaluru market to view data points displayed in Graphs.

displayed in graph with text data. The data retrieved from large set of SQL database, the Fig. 5 above displays table view of onion price data.

It is observed that the trend of onion price is at its peak at year end around November, December and lowest at middle of the year around May, June months. The trend repeats itself year after year for the last ten years.. It clearly depicts the price trend from which the producers can schedule their cultivation and decide on the best period and market for disposal of their produce..

Thus, the MIS with interactive graphical charts display is first of its kind developed by the authors for horticultural commodities. The information presented in graphic format is more easily understood by one and all. The fact that the data sets provide comparison of different markets in graphical view is an added advantage as this information may be of immense use for all stakeholders involved in marketing of horticultural produce. The producer or market intermediary can compare two markets for prices and arrivals of a selected crop over the years and make decision on accessing the market which is beneficial to him. This interactive graphical chart could be further extended to statistical indicators such as simple moving averages and trend analyzing tools etc. This could be embedded with the interactive charts to make charts more dynamic.

ACKNOWLEDGEMENT

The authors wish to thank the NAIP coordinator and PI, NAIP AGROWEB project for providing funds from NAIP project for financing this project, development of website and this paper as well, also thankful for ICAR and Indian Institute of Horticultural and Research, NHB and NHRDF for technical support.

REFERENCES

AGMARKNET 2000 An E-Governance Portal Connecting the Farmers to Their Markets, Microsoft SQL Server Customer Solution Case Study, Sharad Joshi, Former Chairman, High Level Task Force on Agriculture, Govt of India, P. K. Suri, National Project Manager, AGMARKNET. Microsoft SQL server Customer solution case study, Document published January, 2006, Microsoft Corporation. Page 1-5.

Banker, R.D and Mitra,S. 2005. Impact of Information Technology on Agricultural commodity auctions in India. *Twenty-sixth international conference on information systems*. December 9-12, 2004, Washington DC USA, Page 97-107

Randy Schnepf, 2006. Specialist in Agricultural Policy Resources, Science, and Industry Division, Price Determination in Agricultural Commodity Markets: A Primer, for background information on the underlying nature of the different commodity markets. *CRS Report RL33204* January 6, 2006.

Websites/Portals Referred:

http://www.agmarknet.nic.in/: Directorate of Marketing & Inspection (DMI), Min. of Agriculture, Govt of India.

http://www.apccsec.org Asian & Pacific Coconut Community (APCC)

http://www.fao.org Food and Agriculture Organization (FAO)

http://www.nmce.com National Multi-Commodity Exchange of India Ltd (NMCE)

http://www.maratavahini.kar.nic.in, Karnataka State Agricultural Marketing Department/Board

http://rsamb.rajasthan.gov.in/ The Rajasthan State Agricultural Marketing Board

http://megamb.gov.in/: The Government of Meghalaya has set up two secondary regulated markets in the State.

http://www.mpmandiboard.org/: The Madhya Pradesh state Agricultural Marketing Board.

http://www.ccsniam.gov.in/: National Institute of Agricultural Marketing

http://www.manage.gov.in/: National Institute of Agricultural Extension Management

http://nhb.gov.in/: National Horticulture Board

http://www.apeda.gov.in The Agricultural and Processed Food Products Export Development Authority (APEDA)

http://www.ncdc.in/: The National Cooperative Development Corporation (NCDC)

http://www.nafed-india.com: National Agricultural Cooperative Marketing Federation of India Ltd (NAFED)

http://www.nhrdf.com: National Horticultural Research and Development Foundation

http://www.agriwatch.com: Agriwatch.com

Databases Referred and Data sources:

Indian Horticulture Database by National Horticulture Board (NHB), Govt. of India 'Area, Production and Yield of Principal Crops in India',

Directorate of Economics and Statistics, Ministry of Agriculture "FAOSTAT" online database from Food and Agriculture Organization of the United Nations (FAO)

Agricultural Produce Market committee, Bijapur, Hubli, Dharwad and Bangalore, Karnataka

Agricultural Produce Market committee, Madurai Tamilnadu Directorate of Economics and Statistics Department, Karnataka and Tamilnadu

Directorate of Horticultural Department, Karnataka and Tamilnadu

(Ms Received 17 March 2010, Revised 16 June 2011)