PESTICIDE APPLICATION IN GRAPE PRODUCTION FOR EXPORT PURPOSES- A STUDY IN KRISHNA VALLEY OF KARNATAKA

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CO-OPERATION AND BUSINESS MANAGEMENT

UNIVERSITY OF AGRICULTURAL SCIENCES

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Project Report submitted to the

University of Agricultural Sciences, Bangalore

in partial fulfillment of the requirements

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in

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Affectionately dedicated

To

My Beloved Parents, Teachers

&

My Guide

**DEPARTMENT OF AGRICULTURAL MARKETING,
CO-OPERATION AND BUSINESS MANAGEMENT
UNIVERSITY OF AGRICULTURAL SCIENCES
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CERTIFICATE

This is to certify that the Project Report entitled, **"PESTICIDE APPLICATION IN GRAPE PRODUCTION FOR EXPORT PURPOSES- A STUDY IN KRISHNA VALLEY OF KARNATAKA"** *submitted by* ***Mr. SIMRANJEET SINGH,*** *ID NO.* ***MBA 926*** *in partial fulfillment of the requirement for the degree of* ***Master of Business Administration (MBA) in AGRI BUSINESS MANAGEMENT*** *to the University of Agricultural Sciences, Bangalore, is a record of bonafide research work done by him during the period of his study in this University under my guidance and supervision and the Project Report has not previously formed the basis for the award of any degree, diploma, associate ship, fellowship or other similar titles.*

Bangalore
July, 2011

Dr. P.K. MANDANNA
Major Advisor

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July, 2011 *(Simranjeet Singh)*

PESTICIDE APPLICATION IN GRAPE PRODUCTION FOR EXPORT PURPOSES- A STUDY IN KRISHNA VALLEY OF KARNATAKA

Abstract

Grapes are grown on an area of 7.5 million ha. globally with an output level of 67.7 million tonnes. India ranks 12th in production with an output of .187 million tonnes. The present study was conducted in the Krishna valley grape production belt of Karnataka with a sample size of 60 farmers. The main objective of the study was to identify the technology gap and awareness levels of farmers regarding export procedure, standards and pesticide maximum residue level (MRL) information. It was observed that E.U. countries and Bangladesh were the leading destinations for Indian grape exports (43.25% and 37.58 % respectively). There was also a marked increase in Indian grape production, cultivation area and exports over the years of 2001-09(CAGR rates of 6.54%, 6.61% and 35.50% respectively). However it was also observed that there was a significant percentage of farmers both large and small constrained by some level of technology gap (ranging from 13.33%-88.33% across various parameters) and with poor levels of awareness regarding export procedure, specifications, requirements and MRL information of various export destinations. Additionally the current MRL standards specified in Indian legislation were far less comprehensive than the E.U. or U.S.A standards. The reasons behind the occurrence of this technology gap and low levels of awareness regarding export markets and specifications were primarily concerned with economic considerations (53.33%), lack of knowledge/training on the part of farmers (63.33%), non availability of appropriate chemicals and equipment (50%).Thus there appears to be an urgent need for reorientation of current extension strategies to cater to the needs of grape producers aiming at export markets.

Simranjeet Singh

(Mandanna, P.K.)
Major advisor

ರಫ್ತುಗಾಗಿ ಬೆಳೆಯುವ ದ್ರಾಕ್ಷಿ ಉತ್ಪಾದನೆಯಲ್ಲಿ ಪೀಡೆ ನಾಶಕಗಳ ಉಪಯೋಗ : ಕರ್ನಾಟಕದಲ್ಲಿನ ಕೃಷ್ಣ ಕಣಿವೆಯ ಒಂದು ಅಧ್ಯಯನ

ಸಾರಾಂಶ

ಪ್ರಪಂಚದಲ್ಲಿ ದ್ರಾಕ್ಷಿ ಬೆಳೆಯುವ ದೇಶಗಳಲ್ಲಿ ಭಾರತವು ೧೨ನೇ ಸ್ಥಾನವನ್ನು ಪಡೆದಿದ್ದರೂ ಪೂರ್ತಿ ಪ್ರಮಾಣದ ಉತ್ಪಾದನೆ ಮತ್ತು ಉತ್ಪಾದಕತೆಯ ಸಾಮರ್ಥ್ಯವನ್ನು ಸಾಧಿಸಿಲ್ಲ. ಈ ಅಧ್ಯಯನಕ್ಕೆ ೬೦ ಜನ ರೈತರಿಂದ ಮಾಹಿತಿಯನ್ನು ಪಡೆಯಲಾಯಿತು. ೨೦೧೦–೧೧ನೇ ವರ್ಷದಲ್ಲಿ ಭಾರತದಿಂದ ರಫ್ತು ಆದ ದ್ರಾಕ್ಷಿ ಹಿಂದಿನ ವರ್ಷಗಳಿಗೆ ಹೋಲಿಸಿ ನೋಡಿದಾಗ ಅದರ ಅರ್ಧದಷ್ಟಿರುತ್ತದೆ. ಇದಕ್ಕೆ ಮುಖ್ಯ ಕಾರಣ ಅಂದರೆ ಪೀಡೆನಾಶಕಗಳ ದುರ್ಬಳಕೆಯಿಂದ ರಫ್ತಾದ ದ್ರಾಕ್ಷಿಯನ್ನು ನಿರಾಕರಿಸಿದ್ದು ಪರಿಣಾಮವಾಗಿದೆ. ಇದಲ್ಲದೆ ಆಹಾರ ಪದಾರ್ಥಗಳ ಗುಣಮಟ್ಟ ಮಾನದಂಡನೆ ಹಾಗು ಗುರುತಿಸುವಿಕೆ ಕಾನೂನನ್ನು ಕಟ್ಟುನಿಟ್ಟು ಮಾಡಿರುವುದು ಆಗಿದೆ. ದ್ರಾಕ್ಷಿಯ ವಿಸ್ತೀರ್ಣ, ಉತ್ಪಾದನೆ ಹಾಗು ರಫ್ತು ಕಳೆದ ೮ ವರ್ಷಗಳಿಂದ ೬.೫೪, ೬.೬೧ ಮತ್ತು ೩೫.೫೦ ಪ್ರತಿ ಶತದಷ್ಟು ಹೆಚ್ಚಾಗಿರುವುದು ಕಂಡುಬಂದಿದೆ. ಬೆಳೆ ರಕ್ಷಣ ತಾಂತ್ರಿಕತೆ, ಸಣ್ಣ ಹಾಗು ದೊಡ್ಡ ರೈತರಲ್ಲಿ ಕೊರತೆ ಇರುವುದು ಕಂಡು ಬಂದಿರುತ್ತದೆ. ತಂತ್ರಜ್ಞಾನ ಕೊರತೆಗೆ ಮುಖ್ಯ ಕಾರಣವೆಂದರೆ ತರಬೇತಿ ಇಲ್ಲದಿರುವುದು ಹಾಗು ಸೂಕ್ತವಾದ ರಸಾಯನಿಕಗಳು ಇಲ್ಲದಿರುವುದು. ರಸಾಯನಿಕಗಳ ಬಳಕೆಯಲ್ಲಿ ಭಾರತೀಯ ಮಾನದಂಡನೆಗಿಂತ ಅಮೇರಿಕಾ ಹಾಗು ಐರೋಪ್ಯ ರಾಷ್ಟ್ರಗಳ ಮಾನದಂಡನೆಗಳು ವಿಭಿನ್ನವಾಗಿರುವುದಲ್ಲದೆ ಇದರ ಬಗ್ಗೆ ರೈತರಲ್ಲಿ ಮಾಹಿತಿ ಇರುವುದಿಲ್ಲ. ಸಣ್ಣ ರೈತರಲ್ಲಿ ರಫ್ತು ಮಾಡಲು ದ್ರಾಕ್ಷಿಯ ಗುಣಮಟ್ಟದ ಮಾನದಂಡಗಳ ಬಗ್ಗೆ ಅರಿವು ಇರುವುದಿಲ್ಲ. ದ್ರಾಕ್ಷಿಯನ್ನು ಆಮದು ಮಾಡಿಕೊಳ್ಳುವ ದೇಶಗಳಲ್ಲಿನ ಗ್ರಾಹಕರ ಬೇಡಿಕೆಗಳ ಬಗ್ಗೆ ರೈತರಿಗೆ ಮಾಹಿತಿ ಇರುವುದಿಲ್ಲ. ಕೃಷ್ಣ ಕಣಿವೆ ಭಾಗದಲ್ಲಿ ಅಭಿವೃದ್ಧಿ ಸಂಸ್ಥೆಗಳು ಹೆಚ್ಚಿನ ವಿಸ್ತೀರ್ಣ ಚಟುವಟಿಕೆಗಳನ್ನು ಹಮ್ಮಿಕೊಳ್ಳಬೇಕಾಗಿದೆ.

ಡಾ. ಪಿ.ಕೆ. ಮಂದಣ್ಣ
(ಪ್ರಮುಖ ಸಲಹೆಗಾರರು)

ಸಿಮ್ರನ್ಜೀತ್ ಸಿಂಘ್

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CHAPTER I

INTRODUCTION

India is a large producer and consumer of agricultural commodities. It produces around 10 per cent of the world agricultural output; however, its share in world export of agricultural commodities is less than one per cent. As of 2009-10, agricultural exports make up approximately 10.6 per cent of our total export basket and amount to Rs 89,522.59 crores. India has achieved self sufficiency in food grain production and now the major concern of agricultural sector is shifting towards achieving higher growth rates of quality production, productivity and export of high value crops. The focus must now shift to horticulture which will not only allow us to achieve greater nutritional security and improve the quality of nutrition available, but also provides us with a gamut of options of high value crops which offer a great potential for efficient use of resources, higher returns per unit area, earning foreign exchange and greater employment generation through post harvest processing and other additional value addition activities in agro industries.

Horticultural crops occupy 8.5 per cent of gross cropped area of the country with a total production of 146.27 mt. It contributes for 29.65 per cent GDP and 52 per cent of the total earnings of the agriculture. At present, India is the second largest producer of fruits (45.5mt) and vegetables (90.8 mt) in the world contributing for 10.23 and 14.45 per cent to the total production of fruits and vegetables, respectively. The international trade in terms of horticultural produce has increased to five folds between 1961 and 2001 from 24 mt to 125 mt. The total export of horticultural produce during 2002-03 was Rs. 67.592 million. There has been a significant increase in area and production of fruits particularly in Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra, Gujarat, Himachal Pradesh, Jammu and Kashmir and Uttaranchal. The Government of India has taken horticulture as a key development area and it is evident from the increased financial outlays in the 9th and 10th five year plans. The main objective of the National Horticulture Mission is to double the horticulture production from 149 million tonnes to 300 million tonnes by 2011-12. The National Horticulture Mission was launched in the year 2004 with a total budget of Rs. 6500 crores. The scheme is fully funded by the Central Government and the scheme was launched initially with an allocation of Rs. 630 crores. The Central Government has provided Rs.1000 crores under the National Horticulture Mission for 2006-07 so that area and production technology could be upgraded in horticulture. National Horticulture Mission seeks to contribute immensely in the second green revolution.

Diversification and value addition are the key words in Indian horticulture in the 21st century. Our country has varied agro-climates which gives us a competitive edge in production and export over an extended period. In different agro climates of the country, different fruits, vegetables and ornamental crops are being grown to cater to the domestic as well as global demands. Value addition is a key word in the development of horticulture as this can provide a lot of employment opportunities in the rural areas and thus strengthening the agriculture sector.

The signing of General Agreement of Tariff and Trade (GATT) by India has evoked a peculiar conundrum for the Indian economy and specifically the agricultural sector and its dependents in the form that it begins the process of opening the sector to world competition without allowing it the degree of freedom enjoyed by other sectors of the economy which face a similar fate. There is a sharp division of opinion among the people who face this sudden change in their livelihoods with its supporters pointing out the increased market access to international markets and the opportunity to increase exports by finding new markets and exportable commodities. On the other hand, there continues to be a strong undercurrent of pessimistic cynicism among Indian cultivators and exporters which find it hard to believe that they will be able to compete effectively in the international markets against the massive agricultural subsidies offered by developed nations to their agricultural sector and the other barriers to trade created in the form of grades, specifications, food safety, traceability, labor standards and other forms of protectionism including Geographical Indications etc. This is quite visible in the fact that there have been multiple instances of rejection of Indian agricultural exports (Shrimps, Grapes etc). The feeling in the air is that this creeping march of globalization and free trade will adversely affect the domestic industries including agriculture. This effect is clearly noticed in the import of apples, fruit juices and oranges from countries like Australia, New Zealand lifting of quantitative restriction for import of agricultural commodities.

Despite the Government assurances that, interests of domestic cultivators will be protected, the future of Indian agriculture is bleak and uncertain if immediate steps are not taken to adapt to the changing market trends and choices and raise agriculture from a subsistence level profession with a high degree of unpredictability and risk to well managed agri-business venture based on sound market research and rooted in efficiency and profitability. In this context there is an urgent need to assure and prepare our farmers to face the challenges from the foreign imports and orient our cultivators to produce export quality product, so that they can make use of the opportunities of WTO agreement.

Grape is a non-climacteric fruit (berry) that grows on the perennial and deciduous woody vines of the genus *Vitis*. Grapes can be eaten raw or they can be used for making jam, juice, jelly, vinegar, wine, grape seed extracts, raisins, molasses, grape seed oil, confectionery. Most grapes come from cultivars of *Vitis vinifera*. Minor amounts of fruit and wine come from American and Asian species such as *Vitis labrusca*, *Vitis riparia*, *Vitis rotundifolia*.

With an estimated global production of 67.7 million tonnes in 2008-09, grape is grown in about 90 countries around the world covering an area of 7.5 million ha with an average global productivity of 9.1 tonnes an hectare. Italy is the leading producer of grapes followed by China and the US. In terms of productivity, India tops the global charts with a yield of 26.2 tonnes an hectare followed by Iraq (23), Israel (19) and Korea (18.3). Because of the tropical climate and special arbour training systems provided for grape cultivation in India, productivity is highest among the grape-growing countries of the world. Approximately 82 per cent of world grape production is used for wine, 8 per cent as fresh fruit, and 10 per cent for raisin making. However, in India, out of the total grape production, 85 per cent is consumed fresh, 12 per cent is dried for raisins, 1-2% is used for juice and the balance for making wine.

Grape is an important commercial fruit crop of India which contributes to the maximum share of export of fresh fruits and vegetables from India to Europe and other parts of the world. India is 12th largest grape producing country in the world. The country has shown a steady increase in the production of grapes in the past few years. The rise in yield can be attributed to more acreage and better productivity levels as a result of cultivation of improved varieties and adoption of better cultivation practices. During the year 2008-09, the crop was grown in an area of 79,600 hectares, with a production of 1.87

million tonnes and productivity of 26.2 tonnes per hectare. Though grape occupies only 1 per cent of the total area under fruits, it contributes to about 2.7 per cent of the total fruit production of the country and is considered as a high value horticultural commodity. The area under this fruit has increased by 50 per cent and its production by 71 per cent in the country in the last decade (1994-2004), mainly due to its economic importance. Its economic significance is due to good backup of grape industry in terms of backward and forward linkages that offers employment to a large number of skilled and unskilled people on the farm, trade and service. Grape cultivation in India is concentrated mainly in the peninsular India and parts of northern India. Thompson Seedless is the ruling grape variety occupying 55 per cent of the area with its clones. Bangalore Blue occupies approximately 15 per cent of the total area while Anab-e-Shahi and Dilkhush (15%), Sharad Seedless (5%), Perlette (5%) and Gulabi and Bhokri (5%) are the other commercial varieties. Arrival of grapes to the domestic market starts in middle of January and the peak time of availability is during February-March. Availability season is extended further to April-May by keeping the produce in cold stores. Maharashtra and Karnataka are the largest grape producing states in India with:

- Maharashtra is the highest contributor (about 48%) to the total grape production in India with major pockets such as Nasik, Sangli, Solapur, Pune, Satara, Ahmednagar and Osmanabad.
- Karnataka contributes about 31 per cent of the production with the important growing districts such as Bijapur, Bagalkot, Kolar and Bangalore.

Present scenario in Karnataka

Karnataka is the second largest grape growing state in India after Maharashtra, with an area of 9721 ha with a production of 1,67,044 tonnes and productivity of 17.2 tonnes per ha (recorded as high as 72.54 t/ha from Bijapur). Grape growing regions are located in the north interior Karnataka and south interior Karnataka agro-climatic regions of the state.

North Interior Karnataka, comprises of Bijapur (the chosen study area), Bagalkot, Belgaum, Koppal, Bidar and Gulbarga where temperature ranges between 9°- 44°C. Average rainfall is 400 mm which is confined to June-September. Soils are medium clay with high pH and saline alkali in nature. Thompson seedless, Tas-A-Ganesh, Sonaka, Manik Chaman, Sharad seedless and flame seedless are the predominant varieties grown. Double pruning and single cropping is the cropping system. More than 50 per cent of the seedless grape productions are dried for raisins. Problems of viticulture in North Interior Karnataka are, i) soil and water salinity, ii) Acute water shortage and iii) Saturation in domestic raisin market.

India exports a marginal volume of its grape output constituting about 1.3 per cent of the world's total grape exports. In 2009, India's grape exports stood at Rs 4.09 billion (0.125 million tonnes) mainly to Bangladesh (38%), Netherlands (25%), the UAE (12%) and UK (13%). Other export destinations include Nepal, Belgium, Saudi Arabia and Germany. Though the harvesting season of grape in India starts from January and extends to October, the export season of grapes spans from January to April. During this period, South Africa and Israel are the main competitors. India also exports marginal quantities of raisins, constituting about 0.02 per cent of world's exports and wine, constituting about 0.01 per cent of world's exports. India imports marginal quantities of fresh grapes, raisins, wine and grape juice.

The grape industry in India has developed due to the continuous efforts of grape growers in the country. Wandering one gathers honey is an adage suitable for the grape growers. They travel all over the world in search of knowledge on modern viticulture information. From seeded varieties to Thompson seedless and its clones; from local marketing of table grapes to export of table grapes; from raisin making to wine making; the journey has been thrilling and encouraging. There is always a step forward every year. The industry has learned to stand on its own feet. But it was not possible to achieve all the developments without policy support, research organizations and extension ; Research and development is a continuous process. In this modern information age, the role of appropriate information package and its dissemination is equally important. Generating and delivering information to the end users is the imperative exigency. Indian Institute of Horticulture Research (IIHR) Bangalore, which is a premier national institute for Horticulture research, is conducting interdisciplinary research programmes on grapes since its inception in 1968. IIHR is conducting research on grape under four heads *viz.*, crop improvement, production technologies, crop protection and post harvest technology. It also undertakes training programmes for farmers, scientists, officers of Department of Horticulture and organizes on-farm demonstrations. Another important Institute engaged specially in grape industry is National Research Centre on grapes located at Manjri, Pune. It started functioning at Pune from 18th January 1997. In addition to conducting research on above said broad areas, it also tackles the marketing problems by improving the quality of grapes to international standard thus helps in increasing the export of table grapes.

Agricultural and Processed Food Products Export Development Authority (APEDA) is undertaking many development programmes promoting domestic marketing as well as export and providing information on export of grapes. National Horticulture Board (NHB) as an autonomous society in the country with centers all over India promotes integrated development in horticulture and provides many facilities to the horticulture farmers. It also Provides post harvest management infrastructure, hi-tech horticulture, market information system and horticulture data base, assist R & D programmes and provides subsidy to horticulture crops. In addition to the above the other organizations engaged in grape production and marketing research are: Grape Growers Federation of India, State Universities of Agricultural Sciences, Dharwad and Bangalore and other research institutes of ICAR.

The Karnataka state Department of Horticulture has established a separate grapes division and appointed a Special Officer (Grapes) in the rank of Deputy Director of Horticulture. The major functions of this division are to help the grape growers with its programmes like long term financing and providing crop loans arranging for important inputs like sulphate of potash, providing subsidy (particularly drip irrigation), regular technical know-how with the wide network of extension staff. Karnataka Grape Growers Association, Bijapur was established in the year 1989 with a motto to serve the grape growers of Karnataka. The main activities of the Association are, supply of pure quality agro inputs, conducting seminars every year in district places, providing latest technical know how, about pruning, water management, fertilizer application, use of proper hormone, control of pest and diseases and to grow export quality grapes, inviting scientists from IIHR, Bangalore, NRCG, Pune, UAS, Dharwad and Bangalore CFTRI, Mysore, MRDBS and Maha Grapes. Helping farmers in export in collaboration with KAPPEC are some of the important activities of the association.

Grape cultivation involves huge investments on non-recurring items for a period of at least two years of pre-bearing. Also the crop production demands huge quantities of funds for inputs and labor. With the objectives of relieving the farmers from the financial stress and to encourage grape production in the state, NABARD is providing refinance facilities to commercial banks, co-operative banks and Land Development Banks to assist grape growing farmers. For vine development, long term loan is provided through taluk level Primary Land Development Banks based on level of investment required. Apart from this, crop loan is provided to purchase inputs for grape production on annual basis by District Co-operative and commercial banks.

Agricultural policy and extension efforts in India has been hitherto focused on increasing yields to ensure availability and this has been the case for grape production as well, but as we venture into world markets there has been shift in focus towards producing quality goods with a greater degree of value addition which follow international quality and food safety norms so as to ensure wider acceptability. This is already being witnessed in the case of other major agricultural export commodities like tea but needs to be implemented at a wider level for grape and other vale added grape derived products as well. In addition to specific quality and grade parameters, consumers of both domestic and export markets are now also vigilant on the issue of health and safety parameters of agricultural produce with the issue of chemical residues of agrochemicals coming to the forefront in the recent years. They have conclusively demonstrated a willingness to pay a premium price for organically grown food free from agrochemical residues. Additionally the indiscriminate use of chemical fertilizer has adversely affected the soil quality, the indiscriminate use of pesticides has resulted in resistance to pests, resurgence of minor pests and high level of pesticide residue in commodities has created a situation where more than Rs. 4000 crores worth of Indian exports get rejected every year. High agrochemical residues in food chain cause poisoning and deaths through organ dysfunctions, immuno suppression, neurotoxicity, impairment of reproductive functions, carcinogenecity, tumorgenecity and paralysis etc.

Besides harming non-target beneficial flora and fauna it also imposes additional burden on exchequer by creating a health crisis for not only the consumers but the farm workers as well.

Extensive extension efforts have created large gains in grape productivity in the recent years but to ensure farmers get appropriate returns on their heavy investment it is essential to produce grapes with deeper knowledge of consumer needs and expectations. Recent string of export rejections and restrictions of grape consignments specially to the European Union, the latest being in 2010, show that there is great need for proper education of grape producers regarding Good Agricultural Practices(GAP) and other certifications and standards like R.E.A.C.H (**R**egistration, **E**valuation, **A**uthorization and Restriction of **Ch**emical substances) and other maximum residue level standards for widely used agro-chemicals in order to ensure that Indian grape producers are not shunted out from major international export destinations, especially European Union. This issue has been used in the past as well to create technical barriers to trade and could be used as leverage against developing nations in the AOA (Agreement on Agriculture) negotiations. It is up to the policymakers, institutions and extension workers of our agricultural sector to prepare for this eventuality by significantly expanding the knowledge level of our farmers in regards to food safety and MRL (maximum residue level) and ADA (Acceptable Daily Intake) standards. In addition to creating a knowledge base, it should also be noted that there is a significant difference between internationally accepted food safety standards and our standards. This study aims to bridge this gap by a small extent by providing an insight into the knowledge level of our grape cultivators, factors associated with agrochemical usage, and compiling the various international export standards contrasted with national standards for handy reference by studying grape cultivation in Bijapur district with the following specific objectives:

- To document grape production, export and destination.
- To study the technology gap and factors influencing pesticide usage pattern in grape production
- To study maximum residue level (MRL) information and degree of awareness for export markets.
- To suggest suitable corrective strategies to meet export standards.

This study is expected to provide useful information for farmers and researchers looking deeper into the technology gap in regards to agrochemical usage in grape production, especially regarding food safety standards as they vary across various export destinations. It will also be useful to gauge the awareness level of farmers regarding the changing MRL standards and GAP for various export destinations, most noticeable the E.U which has recent rejected various grape shipments on these very issues.

Presentation of the study

The project report is organized into six chapters. The first chapter provides a brief introduction along with the specific objectives. In second chapter, some pertinent reviews are presented in consonance with the study objectives. Chapter-III describes main features of the study area, sampling framework, database and analytical tools employed in the analysis of data. The empirical results are presented in chapter-IV, followed by critical discussion in chapter-V. Finally, chapter-VI summarizes the major findings of the study and policy implications.

Limitations of the study

This study was based on primary data collected from sample farmers by survey method. As many of the farmers furnished the required information from their memory and experience, the collected data would be subjected to recall bias. The study area was limited to Bijapur district and the findings may not be applicable to other, as vast difference exists among the farmers with regard to income, land area, agro-climatic conditions, marketing infrastructure, extension information availability, demographic, psychographic characteristics etc. Hence, the findings of the study may be considered appropriate for the situations similar to study area and extra care should be taken while generalizing the results.

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Review of literature is an eventful facet of any scientific endeavor as it helps the researcher to develop good understanding of the subject and to formulate appropriate research methodology. It helps the researcher to identify the problems and relate the empirical findings to those done in the past.

2.1 Documenting grape production, export and destination.

Growth rates are measures of performance of economic variables. They are not developed to predict; but describe the trends in variables over time. Hence, they are commonly used as indicators of trends in the time series data. Price indices, productivity indices and output series are usually discussed in terms of the changing growth rates over a period of time. Policy decisions are often based on such growth rates that depend on nature and structure of the data.

Parathasarathy (1984) measured the growth rates and instability in agricultural production for different districts of Andhra Pradesh. He used Schultz's (1953) year-to- year variation as one of the approaches to measure instability. He concluded that the degree of instability in agricultural production was high in all districts. It was higher for food grains than for 'all groups'. The districts of north coastal Andhra combine high instability with low growth. Nalgonda district in Telungana was rather unique in having experienced high growth rates of production with low instability. The post green revolution period showed a higher degree of instability. The districts which achieved higher growth rates were also subject to greater instability.

Sharath (1993) analysed the growth in exports of cardamom from India using exponential function of the form Y = abt•. A comparative performance was attempted splitting the time period into two, the first period from 1970-71 to 1979-80 and the second from 1980- 81 to 1989-90. In the first period, the quantity of Indian exports registered a growth rate of 4.63 per cent while the value of exports grew at the rate of 27.9 per cent. These were mainly attributed to 23 per cent increase in unit value realization in contrast to 17.05 per cent decline during the second period.

Patel and Agarwal (1994) studied the growth and instability of groundnut production in Saurashta region of Gujarat district and concluded that there was a negative trend in area, production and productivity of groundnut for the two periods *viz.*, 1960-61 to 1969-70 and 1970-71 to 1988-89 under study. The growth rates of area, production and productivity for groundnut during the second period in Gujarat state were -0.48 per cent, -1.78 per cent and -1.21 per cent, respectively.

Bastine and Palanisamy (1994) analyzed the growth rates of area, production and productivity of major crops in Kerala including the cereal crops and the plantation crops. They indicated that pepper showed positive but non significant growth rates in area and production while insignificant in case of productivity. The production instability measured using coefficient of variation indicated a high order for crops like pepper, coffee, rubber, ginger and tapioca. Old and senile plants requiring replacements, poor genetic traits and poor management, attack of quick and slow wilt and pollution, disease and high cost of production acted as major factors for low productivity in pepper.

Kuruvila (2001) reviewed the export performance of pepper during global scenario. The growth rate on pepper production and export were

0.66 per cent and 4.26 per cent, respectively. These growth rates were far below to Vietnam's growth rates of 13.40 per cent and 7.84 per cent in production and export during 1990-2000. However, Brazil, Indonesia and Malaysia had negative growth rates during the same period in production and export.

Rajesh *et al.* (2002) measured the trend in export of major spices in India for the period 1970-71 to 1999-00 and found that black pepper registered a positive annual growth rate of 2.38 per cent in quantity and 12.78 per cent in value. While large cardamom registered 12.76 per cent of export quantity and 21.4 per cent export value, ginger registered 4.05 per cent growth in quantity and 10.15 per cent in value. Turmeric export registered 4.14 per cent in quantity and 13.08 per cent in volume during the period under study.

Srivastava *et al.* (2003) worked out compound growth rates of area, production and productivity of pulses in all the district of eastern Uttar Pradesh during 1975-76 to 1999-2000. The results revealed that area and production of pulses declined at the rate of 1.8 and 0.67 per cent per annum, but productivity increased at a compound growth rate of 1.18 per cent per year.

Sharma and Sharma (2003) studied the production and export performance of tea and reported that 'the growth rates were positive for area, production and productivity of tea. The share of Indian tea export in the total export was as high as 72.17 per cent in 1950, which had steadily declined to 23.79 per cent in 1999. Malik *et al.* (2004) studied the trends prevailing in area, production and productivity of onion in world and India. It also analyzed the trend of export of onion from India.

El Sawalhy *et al.,* (2008) analyzed the Egyptian grapes market shares in the world markets and reported that the main exporter countries of grapes through the period 2001-06 were Chile, Italy, South Africa, Netherlands, Turkey, Spain and Greece while the main importer countries through the same period were Germany, UK, the Netherlands, France, Belgium and Saudi Arabia.

2.2 Technology gap and factors influencing pesticide usage pattern in grape production.

Gap in the adoption of recommended practices has been studied all over the country in various fields of agricultural technology. Studies reviewed to know the extent of technological gap are presented below:

The All India Co-ordinated Research Programme in Extension Education, Indian Agricultural Research Institute (1979) gave a formula to assess the technological gap, according to which the technological gap is the deviation from the recommended levels technology expressed in percentage.

Venkateshwaralu *et al. (*1984) attempted to examine the reason for being brand loyal. During their study they found that 50 per cent of consumer respondents preferred a particular brand, science they were convinced with its quality is better than that of other brands. Another 38 per cent of the sample consumers felt taste makes them to go for a particular brand, very few consumers in the sample have stated low price and easy availability were the reasons for selecting a particular brand. The implications are clear that consumers are fairly brand conscious and hence, effective brand strategy has its role in effective marketing.

Chitnis and Bhilegaonkar (1985) in their study about the technological gap in dry farming system reported that mean technological gap was highest for small farmers followed by medium and large farmers in respect of dry land technologies, namely, varietal recommendation, sowing technique, use of fertilizers, plant protection measures, horticultural operations and inter-cropping technologies. The study indicated that small, medium and big farmers differed significantly with respect to their degree of technological gap. The study was conducted in Aurangabad district of Maharashtra.

Jaiswal and Rathore (1985) observed that the technological gap in wheat cultivation practices was 57.1 and 72.4 per cent, respectively amongst the categories of irrigated and unirrigated category of farmers in Damoh, Madhya Pradesh. It was revealed that the technological gap was highest in respect of fertilizer application, seed treatment and plant protection for both categories of farmers.

Pillai and Subramonian (1986) in their study about technological gap in integrated soil conservation practices has revealed that technological gap was high in agrostologic practices like planting of grass species such as Congo signal all along the top and sides of contour bunds. The composite technological gap in integrated soil conservation practices was found to be 48.37 per cent.

Jaiswal *et al.* (1987) revealed that there existed 24 per cent adoption gap in respect of wheat cultivation technologies in Bundelkhand region of Madhya Pradesh.

Srivastava and Singh (1990) reported that technological gap was highest in respect of fertilizer application in all categories of farmers. It was 56 per cent and 76 per cent in case of marginal farmers with regard to nitrogen and phosphorus fertilizer respectively. While the same was 78 and 75 per cent in case of small farmers, it was 46 per cent and 90 per cent in case of medium farmers. The gap in Nitrogen fertilizer application was 64 per cent in case of large farmers while the same in respect of phosphorus fertilizer was 78 per cent.

Rao and Veerbhadraiah (1993) reported that out of the fourteen low cost technologies identified in paddy only three were found to be adopted by more than 70 per cent of the farmers. These practices were correct method of irrigation to nursery. Practices like seed treatment, deep application of green manure to main field, correct method of fertilizer application to main field, like planting, chemical, weed control and correct method of top dressing were adopted by only 2-5 per cent of the farmers.

Sivakumar *et al. (*1994) analysed buying behavior of farmers with respect to pesticides, considering the factors influencing loyalty of farmers towards dealer and brand. Friends, neighbors and relatives were the major source of information about dealers. In case of brands, it was extension personnel of the department of agriculture. The price, quality and advertisements of the brand contributed significantly to brand loyalty. Credit availability, advertisements and price of products available with dealer contributed significantly to dealer loyalty.

Mahawer *et al.* (1995) in their study about the technological gap between beneficiaries and non-beneficiaries of scheduled caste research project in Rajasthan revealed that there was a wide gap (68%) in the knowledge possessed by the beneficiary farmers in respect of plant protection measures, where as it was 89.34 per cent in case of non beneficiary farmers. The study showed that there was significant difference in the knowledge level of beneficiaries and non-beneficiaries in other areas of wheat production technology viz, use of high yielding varieties, seed rate and seed treatment, fertilizer application, improved agricultural implement and overall knowledge.

Patil and Deshmukh (1995) reported that there was an overall technological gap of 39.57 per cent in case of contact farmers and 57.73 per cent in case of potential farmers in respect of selected practices of paddy cultivation. The gap was highest in case of use of chemical fertilizers for main field (81.83%), use of chemical fertilizer nursery (50%) and seedbed preparation (40%) for contact farmers. But the technological gap in case of potential farmers was highest for plant protection (93.75%) followed by use of chemical fertilizer in main field (89.52%).

Singh and Chuhan (1996) in their study about the technological gap in mustard concluded that there was 54.50 per cent technological gap in the use of recommended mustard production technologies. The technological gap was highest in case of seed treatment (90%) followed by plant protection measure (68%) and fertilizer application (54%).

Nikhade *et al.* (1997) in their study about technological gap in red gram, green gram and Bengal gram in Gulbarga district of Karnataka observed that a wide gap (43%) was observed in the use of plant protection measures, followed by application of nitrogenous (31%), phosphatic (25%) fertilizer and seed rate (29%) in cultivation of red gram

Singh and Sharma (1998) revealed that more than half of the respondents (54.45%) did not adopt seed treatment in paddy. Lack of knowledge and lack of availability of chemicals were the major reasons for non-adoption. Majority of the respondents (37.7%) reported that they used more seed rate because of damage caused by birds and animals and also due to poor germination. The study revealed that none of the farmers adopted line sowing. It was found that 32.5 per cent of the respondents applied more than the recommended dose of fertilizers, while 70 per cent of the respondents applied less than the recommended dose. The study revealed that 93 per cent of the farmers were in the non-adopter group regarding herbicide application.

Nagaraj (1999) reported that none of the big and small groundnut farmers adopted practices like seed treatment with chemicals, weedicide application, plant protection measures, opening dead furrows, use of grass outlets and farm ponds in groundnut cultivation.

Karanth (2002) studied MRL levels in vegetables and found that in most cases the residue burden was less than the maximum residue limits (MRLs), with some exceptions and suggested that chemical residues in vegetables were due to pick-up from the contaminated soil by plants and migration to edible parts.

Aubertot *et al.*, (2005) reported that although vineyards represent only 3% of French cultivated areas, they utilize some 20% of its pesticides.

Kostadinov *et al.*, (2008) studied effect of technology and regional conditions on the cost of grape production and reported that costs related to plant protection had the greatest share in the total costs.

Dhere *et al.,* (2010) studied hygienic problems of farmers and farm-workers caused by agrochemicals and found that Illiteracy among the farmers and farm workers was the major reason behind improper handling and application of the toxic pesticides.

Ugaglia *et al.*, (2011) studied the issue of pesticide reduction in vineyards. After analyzing grape growers' pesticide lock-in they reported that, although Integrated Pest Management (IPM) could reduce pesticide use significantly, the lack of specific implementation know-how hampers its diffusion.

2.3 Maximum residue level (MRL) information and degree of awareness regarding export markets

Kumbar (1983) in his study on grape growers in Bijapur district of Karnataka state reported that, the important grape cultivation practices like spacing, propagation, planting, training and pruning, manuring, irrigation frequency, gibberlic acid treatment and plant protection measures were partially adopted by the grape growers.

Ramesh Babu (1987) conducted a study on grape growers in Bangalore and Kolar districts and reported that, adoption pattern of grape growers with respect to each of the specific practices differed. The big farmers had higher adoption level than small farmers and similarly, the small farmers had better adoption level than marginal farmers. In general, the adoption level of all the three categories was high.

Ajaykumar (1989) in his study revealed that, several recommended grape cultivation practices like suitable soil, recommended variety and training method of grapes were followed fully by the grape growers. Large majority of them fully adopted the practices like spacing, pit size, time and number of buds at pruning, fertilizer application and plant protection measures.

Angadi *et al.* (1992) observed that, majority of the farmers (58%) possessed medium knowledge of cultivation practices of groundnut. This trend was noticed since many farmers lacked proper knowledge of complex practices like application of chemical fertilizers and plant protection measures.

Chikhale *et al.* (1996) conducted a study in Amaravathi district of Maharashtra state and reported that; majority (60.50%) of the orange growers had medium level of adoption of recommended cultivation practices followed by low level of adoption (22.50%) and high level of adoption (14.00%).

Ravishankar and Katteppa (1998) in their study on adoption behaviour of potato growers in Karnataka state noticed that, cent per cent of the potato growers adopted the use of improved seed. The practices which were partially adopted by farmers were recommended seed rate (81.66%), seed treatment (30.00%), optimum spacing (60.00%), FYM (56.66%), use of insecitides (28.33%) and use of fungicides (24.16%).

Vijaykumar and Narayanagowda (1999) in his study on rose in Bangalore district indicated that, almost all the respondents had adopted the practices like time of harvesting (100.00%) and varieties (93.00%). Great majority of the rose growers adopted the practices such as, use of weedicides (81.00%) and spacing between rows (72.00%). While, majority of respondents had adopted practices like number of prunings (64.00%), plant protection measures for insects (57.50%), diseases (47.50%), spacing between plants (47.00%) and recommended level of fertilizer application (32.50%)

Ahire *et al.* (1999) observed that most of the grape growers lack the knowledge about grading and packaging, stage and time of harvesting, recommended harvesting schedule occurrence of pest, fertilizers, application, before October/April prunings and recommended soil for plantation. Whereas, a majority had high level of knowledge about improved practices of cultivation as training pruning spacing and growth regulators.

Venkataramalu (2003) conducted study on the knowledge level, adoption and marketing behaviour of chili growers in Guntur district of Andhra Pradesh and found that, majority (68.33%) of the respondents were found to be in medium adoption category, followed by low (20.00%) and high (13.33%) adoption category, respectively.

Moulasab (2004) conducted a study in North Karnataka and reported that, majority of the mango growers (68.33%) were found to be medium adopters, followed by low (19.00%) and high (12.67%) adopters.

Jiwan Prava Lama (2008) highlighted some aspects of pesticides contamination in foods and the Government of Nepal's experience in setting MRLs of pesticide on food with recommendations for proper use and management of pesticides.

2.4 Suggesting suitable corrective strategies to meet export standards.

Subrahmanyam (1984) stressed that the production constraint is one of the important constraints affecting the export potentialities of horticultural products. He noted that other important constraints were low productivity, lack of suitable varieties for processing, pests and diseases, extreme shortage of supply of quality materials and non-availability of technical information on the aspects of post-harvest handling. Regarding infrastructural facilities he noted that there was a lack of storage facilities, pre-cooling chambers, packing, refrigerated transport, expensive air cargo freight. He also estimated that nearly thirty per cent of produce was lost through inadequate knowledge of harvest, handling, packing, transport and storage.

Kantharaju (1989) reported that the incidence of pest and diseases, failure of rainfall and poor planting material were the problems. The problems related to the credit were insufficient time for repayment of loan, non-availability of credit in time and inadequate amount of credit. High rate of taxes, large transportation cost and lack of transportation were the main marketing problems.

Rajashekharan and Radakrishnan (1989) analysed the export performance of cashew and noticed that India’s share in world cashew kernel export, which was almost one hundred per cent in 1950, declined sharply to 55 per cent in 1986. In 1987-88, their share declined further to 42 per cent. They identified non-availability of raw nuts, inadequate quantities and stiff competition from other countries like Brazil. They suggested that if the country is not to lose further, it is essential that raw nut production should be increased preferably by increasing in the productivity.

Gulati *et al.* (1994) observed that the canalization of onion through NAFED has led to loss of share in export market because of intervention of NAFED, whenever there is escalation of price in the domestic market, the infrastructure for storage, transport, internal as well as international was largely inadequate. The interest on export finance was high (13%) and it should be brought down to nine per cent per annum. Institutions such as farmers, exporter, co-operatives like Maha grapes and Maha mango were considered most useful in the export promotion of fruits and vegetables. This is essential to ensure good quality product as well as remunerative returns to the farmers.

Thakur *et al.* (1994) identified the problems encountered by the farmers in marketing of vegetables. They were (1).unorganized marketing and low prices paid to farmers, (2) lack of mechanical grading, packing, and proper storage facilities, (3) malpractices, high and undue marketing margins and costs in markets.(4) lack of village roads, lack of sufficient and low cost transportation facilities. (5) lack of market information and market news, and (6) lack of processing units and cooperative societies.

Deorukhakar *et al.* (1995) studied the constraints in technology adoption of cashewnut cultivation in the Sindhudurga district of Konkan region, Maharashtra. They found that one-third of the growers (68%) opined that there was no need to use of fertilizers and plant protection chemicals, high cost of fertilizers (13%) and plant protection chemicals

(27%) were other constraints expressed by the cashew growers. They further reported that the 41 and 32 per cent of the respondents expressed the high cost of improved planting material and irregular supply of this input, respectively.

Nasurudeen and Balakrishnan (1996) identified the problems of agricultural exports in India; the major constraints were high tariff, qualities restrictions, quota, strict hygienic standards package standards, and labeling requirements. They reported that the most important problems in export of agricultural commodities were mainly due to inadequate surplus. Adopting modern technology should enhance the productivity. Most of the technological advancement was coupled with capital intensity but the availability of capital was less and also the capital formation in agricultural sector was meager with 2.2 per cent only.

Balasubramani (1997) in his study on knowledge and adoption behaviour of rubber growers in Belthangadi taluk of Dakshina Kannada district suggested that, efforts should be taken to intensification of educational activities by the field extension workers of rubber board in the areas of fertilizer use, cover crops, insect and disease control, micronutrients, herbicides etc. Mass media should cover the latest rubber technology, printing of literature relating to rubber cultivation in local language.

Babanna (2001) in his study on arecanut in Shimoga district suggested that, educating farmers in identification and control of pests and diseases, provision of remunerative price in time, labour availability and encourage the farmers to adopt the production technologies in arecanut cultivation.

Vedamurthy (2002) in his study on the management of arecanut gardens and marketing pattern preferred by arecanut farmers of Shimoga district in Karnataka state suggested that, educational activities needs to intensified by the extension and other agencies, irrigation facility, loans and subsidies to farmers especially for small and marginal farmers group, to develop the source of irrigation.

METHODOLOGY

CHAPTER III

METHODOLOGY

In this chapter a brief description of the study area, sampling frame, database and method of analysis employed are presented under the following headings:

3.1 Description of the study area

3.2 Sampling design

3.3 Nature and source of data

3.4 Analytical tools and techniques employed

3.1 Description of the study area

Bijapur is one of the largest districts in Karnataka and has an area of 10541 sq. km consisting of 5.49 per cent of the area of the state. It lies between 15^0 50' and 17^0 28' north latitude and 74^0 54' and 76^0 28' east longitude. The district is surrounded by Sholapur district on the north and Sangli on the North West (both of Maharashtra state), by the district of Belgaum on the west, Bagalkot on the south, Gulbarga on the east and by Raichur on the south east. Thus, it is a land locked district on the northern boundary of Karnataka. The Bijapur district consists of five talukas *viz.,* Bijapur, Basavana Bagewadi, Indi, Sindigi and Muddebihal.

The climate of the district is generally dry, the large variation the rainfall, from year to year, both in quantum and its distribution through the seasons. This makes the district more prone to drought and famine. The average annual rainfall of the district is 668.2 mm. The temperature ranges from 14.80 C to 430 C. There are two main types of soils namely black soil and red soil. The main food crops are Jowar, Bajra, wheat and gram. Among the commercial crops groundnut, Sesamum, linseed, cotton, safflower and sunflower are more popular. The medium rainfall, dry and healthy weather are considered to be the ideal conditions for grape cultivation. Bijapur district in Karnataka has all these ideal conditions for successful grape cultivation and is the major grape cultivating district in the northern Karnataka. It ranks first in the area under grape cultivation in Karnataka with 6032 hectare and with a production of 94,692 tonnes during the year 2008-09. Grape cultivation is practiced throughout the district. Hence, Bijapur was specially selected for the study.

Population and demography

According to 2001 census the total population of the district was 18.10 lakhs

Population of the district Total : 18.10 lakhs (18.06918 inhabitants)

Male: 9.07 lakh

Female: 9.02 lakh

Density

The population density of Bijapur district is approximately 172 persons per sq km.

Sex ratio: the sex ratio of the district is 977/1000 (females/males)

Literacy rate

According to 2001 census the literacy rate of the district is at 56 percent stood marginally above the state figure. The literacy rate among male is 57.95 whereas among females it is only 39.14 percent.

Climate

The climate is warm and dry throughout the year and rainfall is scarce. The average annual rainfall for the district is 552.8 mm with 37.2 rainy days. The monsoon generally breaks in the district during June and lasts till October. The highest mean monthly rain fall 149.2 mm in the month of September and lowest is 3.5 mm in February. The annual rainfall variation in the district is marginal from place to place.

Soil type

The major soil types of the district are black soil and red soil Bijapur is very rich in red soil which is conducive to the cultivation of horticultural crops.

Major crops

The major crops grown in this area are, Jowar, Bajra, Groundnut, Linseed, Cotton, Safflower, Sesamum and Sunflower.

Horticultural crops

Grape, Pomegranate, Ber, Sapota and Papaya are the main fruit crops grown. Onion, Lemon, Cabbage, Cauliflower, Tomato and Brinjal are the important vegetables grown in the district.

Sources of irrigation

The main sources of irrigation are Canals, Bore wells and Tanks. Only 17.3 per cent of the net cultivable area is irrigated and the balance 82.7 per cent of the area has to depend on the monsoon.

Land utilization

The total geographical area of the district is 10541 sq km which accounts for 8.9 per cent of the state geographical area.

Map showing the study area

3.2 Sampling design

Bijapur district in Karnataka has all these ideal conditions for successful grape cultivation and is the major grape cultivating district in the northern Karnataka. It ranks first in the area under grape cultivation in Karnataka with 6032 hectare and with a production of 94,692 tonnes during the year 2008-09. Grape cultivation is practiced throughout the district. It forms the heart of Krishna Valley Grape cultivation belt and hence was specially selected for the study.

The district is divided into 5 taluks of which Bijapur taluk was selected for the study.

3.3 Nature and source of data

In order to evaluate the objectives of the study, data was collected from both primary and secondary sources.

1. Primary data: Primary data regarding pesticide usage, exporting knowledge, MRL awareness and associated factors was collected by interviewing farmers, input retailers using pre-prepared schedule.

   The sample size selected was 60 farmers chosen via convenience sampling classified into three equal sub-groups of small, medium and large farmers according to landholding size according to NABARD classification of landholding size.

2. Secondary data: The data regarding area, production and export of grapes was collected from APEDA, Department of Horticulture of Karnataka, Ministry of Commerce, and Indian Horticultural Database.

3.4 Analytical tools and techniques employed

3.4.1 Compound Annual Growth Rate (CAGR)

Compound annual growth rate (CAGR) is an average growth rate over a period of several years. It is a geometric average of annual growth rates. In this study, CAGR technique is used to analyse the growth rate of area, production and exports of grapes from India and in Karnataka.

To calculate the compound annual rate of growth, regression analysis is used where the growth equals $Y= ab^t$ from which CAGR is calculated as CAGR = b-1

3.4.2 Tabular presentation/ analysis

The observational data was arranged in a tabular format to facilitate analysis and usage of tools like percentage, frequency etc.

3.4.3 Relevancy Ranking

This tool was used to rate factors which influence pesticide usage pattern and rank from first to seventh rank was given to factors. The ranking for the factors was on a three point relevancy continuum.

In the questionnaire 7 factors were ranked based on the opinions and Relevancy Coefficient of i^{th} factor was worked out based on the formula:

$$RC_i = \frac{\text{Total score of the respondents for the } i^{th} \text{ factor}}{\text{(Maximum on continuum)Total no. of respondents}}$$

The ranking of each factor was made according to its relevancy coefficient such that factor with highest relevancy ranking ranked first and so on in that order.

RESULTS

CHAPTER IV

RESULTS

The empirical results of the study are presented as below. Keeping the objectives in view, the results are presented under the following headings.

4.1 To document grape production, export and destination

4.2 To study the technology gap and factors influencing pesticide usage pattern in grape production.

4.3 To study maximum residue level (MRL) information and degree of awareness for export markets.

4.1 Grape production, export and destination

Though, grape occupies only 1 per cent of the total area under fruits, it contributes to about 2.7 per cent of the total fruit production of the country and is considered as a high value horticultural commodity. India is 12th largest grape producing country in the world.

Indian grape production has been on a steady upswing. The area under this fruit has increased by 50 per cent and its production by 71 per cent in the country in the last decade (1994-2004), mainly due to its economic importance. The table 4.1 provides hard numbers about the grape area, production and export scenario in India for the period of 2001-09 and the CAGR experienced by the Indian grape industry in form of increase in area, production and exports.

Area under grape cultivation has seen a CAGR of 6.61 per cent for the period of 2001-09 while the production has seen a CAGR of 6.54 per cent. Exports have also seen a remarkable growth in the new millennium with a CAGR of 35.50 per cent quantity wise and 30.70 per cent value wise. A graphical representation of the growth in area, production and exports is presented in fig no. 1 - fig 4

Table 4.1 : Area, Production and Export of Grapes in India (2001-09)

Year	Area (in '000 Ha)	Production (in '000 tonnes)	Exports (Quantity in Tonnes)	Exports (Value in Rs Lakhs)
2001-02	47.5	1184.2	14,606	6,021
2002-03	52.1	1247.8	25,567	10,867.1
2003-04	57.8	1474.8	26,469	10,368.3
2004-05	60.5	1564.7	38,898	12,643.7
2005-06	64.3	1630.7	53,908	21,382.8
2006-07	64.9	1685.3	85,562	30,058.4
2007-08	68.6	1734.7	96,963.6	31,782.51
2008-09	79.6	1878.3	1,24,627.9	40,861.28
Compounded Annual Growth Rate	6.61%*	6.54%*	35.50%**	30.70%**

Source: APEDA, Indian Horticultural Board, DGCIS

*Significant at 1per cent level ** Significant at 5 per cent level

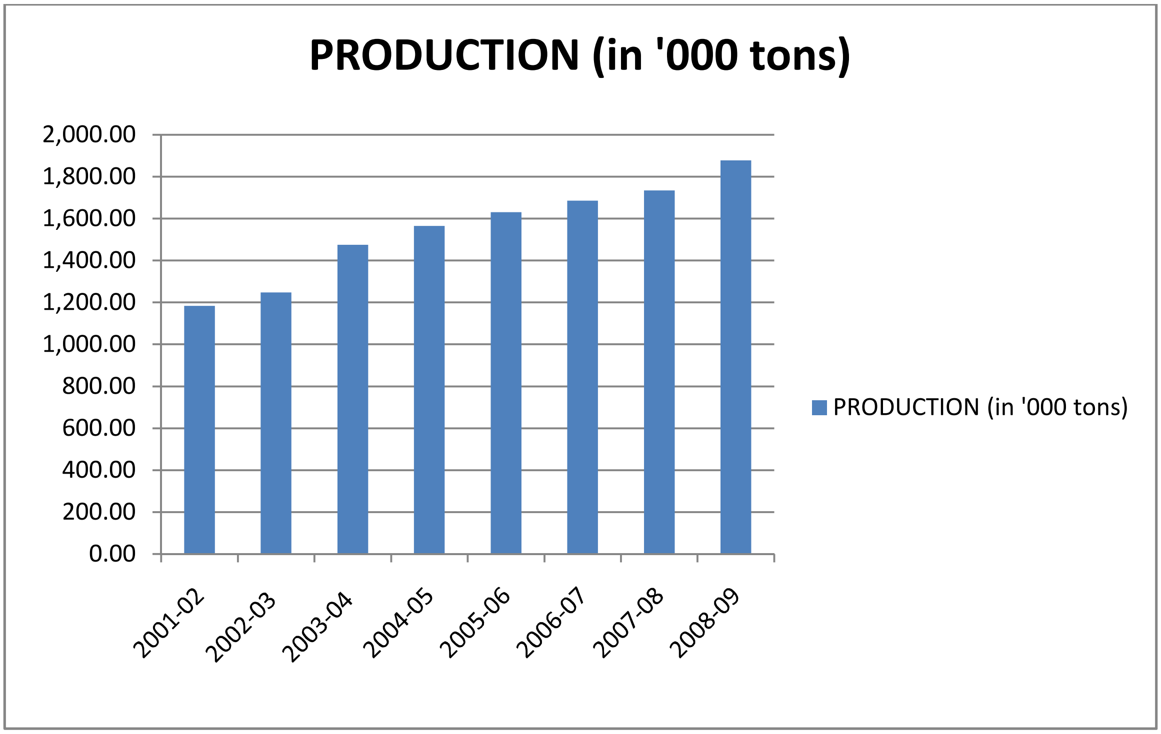

Fig. 1 : Indian Grape Production (2001-09)

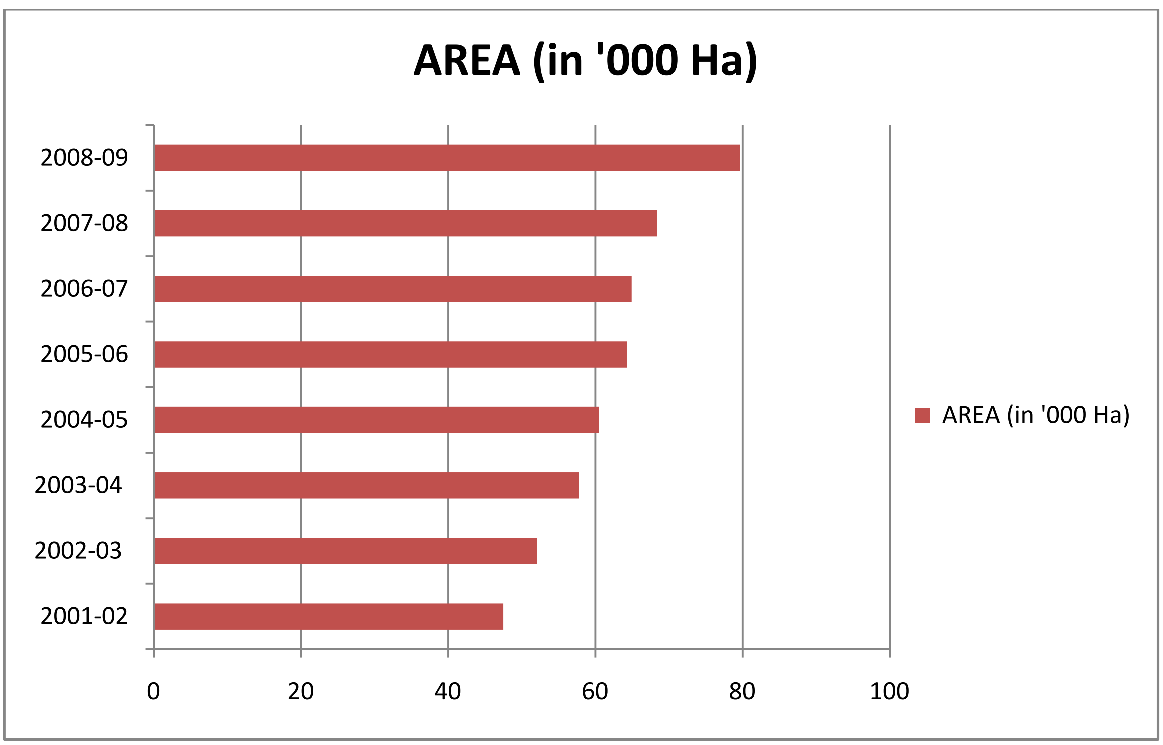

Fig 2 : Area Under Grape Cultivation (in '000 Ha) (2001-09)

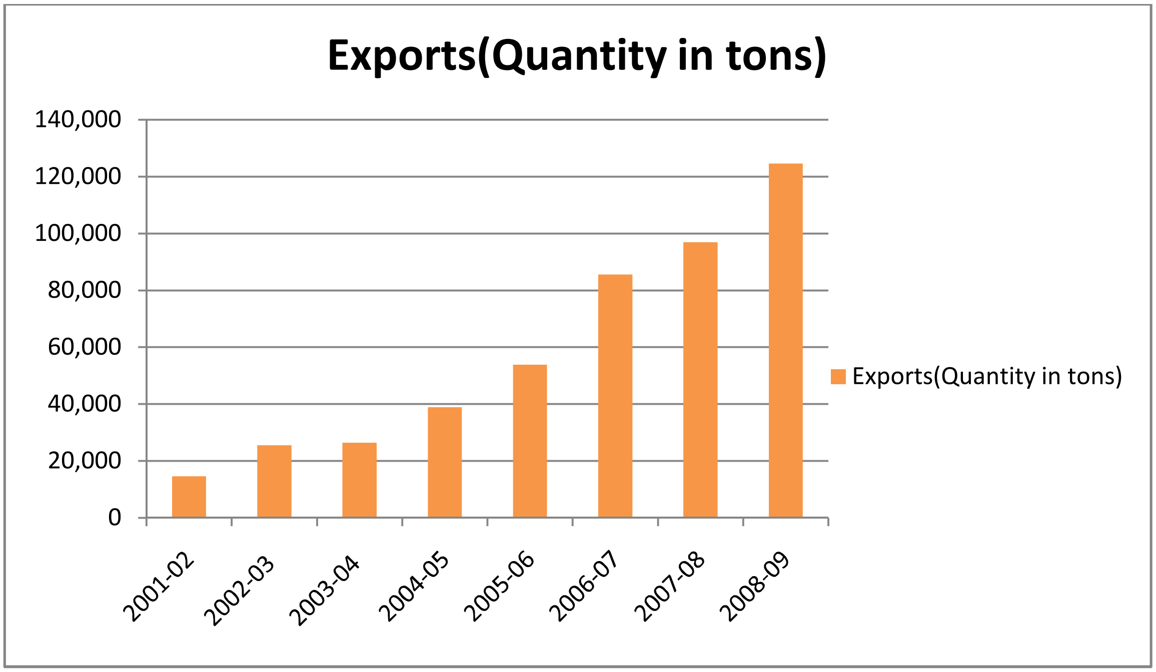

Fig. 3 : Indian Grape Exports Quantity wise (in tons) (2001-09)

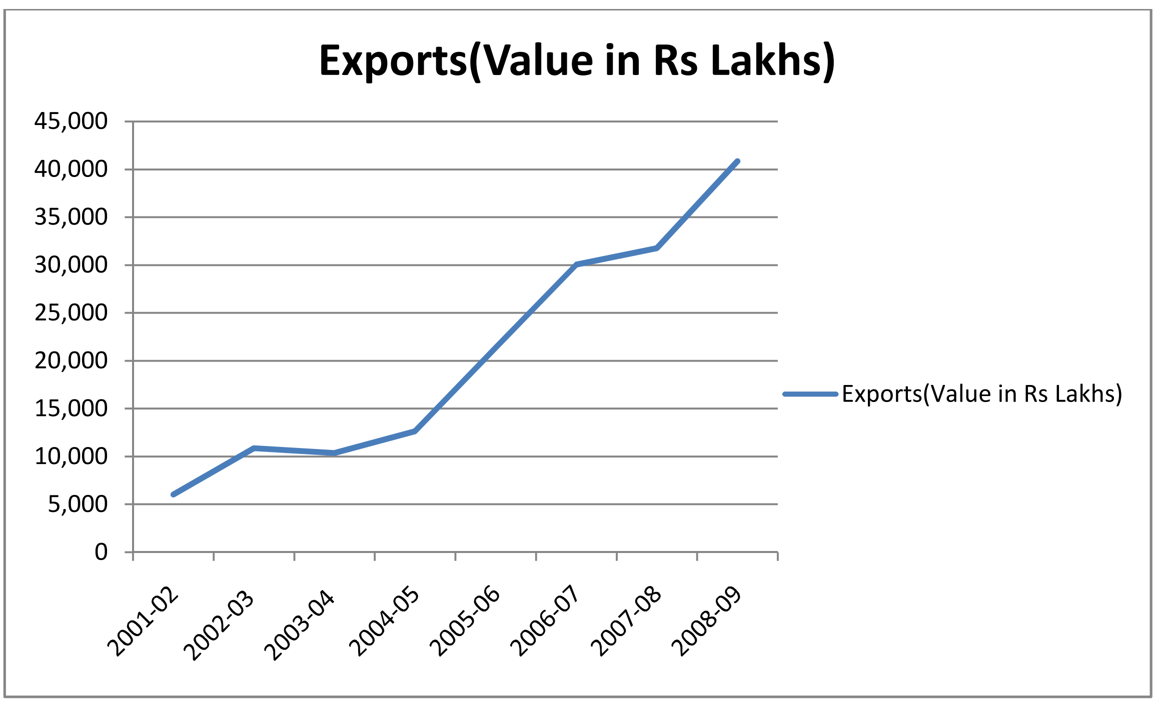

Fig. 4 : Indian Grape Exports Value wise (in Rs Lakhs) (2001-09)

DISCUSSION

CHAPTER V

DISCUSSION

The results presented in the previous chapter are discussed in the chapter under the following headings,

5.1 To document grape production, export and destination

5.2 To study the technology gap and factors influencing pesticide usage pattern in grape production.

5.3 To study maximum residue level (MRL) information and degree of awareness for export markets.

5.4 To suggest suitable corrective strategies to meet export standards.

5.1 Grape production, export and destination

Grape production and exports have shown this remarkable rise on the back of the success story of Maharashtra grape farmers who have pioneered in India the production of grape in huge quantities for export and value addition purposes. Till 4-5 decades ago, its cultivation was considered as non-viable, especially in the tropical areas. However, during the period from 1987-88 to 1999-00, the area under grape has increased from 15,000 ha. to 44,000 ha. and the production from 2.5 lakh tonnes to 11 lakh tonnes. The highest world productivity of 100 tonnes grape per ha. has been recorded in the tropical region of the country. It is now being cultivated in all the 3 major climatic conditions - temperate, sub-tropical and tropical. During the period from 1991 to 92 to 1999-00, the increase in production of grape has shown annual compounded growth rate of 13.36 per cent in Maharashtra.(NABARD Model Projects)

Among all the fruit crops, grape has emerged as the most successful commercial crop in the recent years. The compounded annual growth rate (CAGR) for area expansion and for production for the past

Table 4.2 : Indian Grape Export Destinations (2009-10)

Country	Quantity (in MT)	Value (in Lakh Rs)	Percentage Share
Netherland	87,223	50,651	25.81
United Kingdom	43,079	24,632	12.75
United Arab Emirates	39,616	21,857	11.72
Bangladesh	1,26968	18,827	37.58
Saudi Arabia	15,297	8,178	4.53
Belgium	8,801	5,522	2.60
Egypt	3,920	3,925	1.16
Germany	7,069	3,031	2.09
Morocco	3,012	2,893	0.89
Algeria	2,912	2,526	0.86
Total	**337,897**	**142,042**	100

Source: APEDA, Indian Horticultural Board

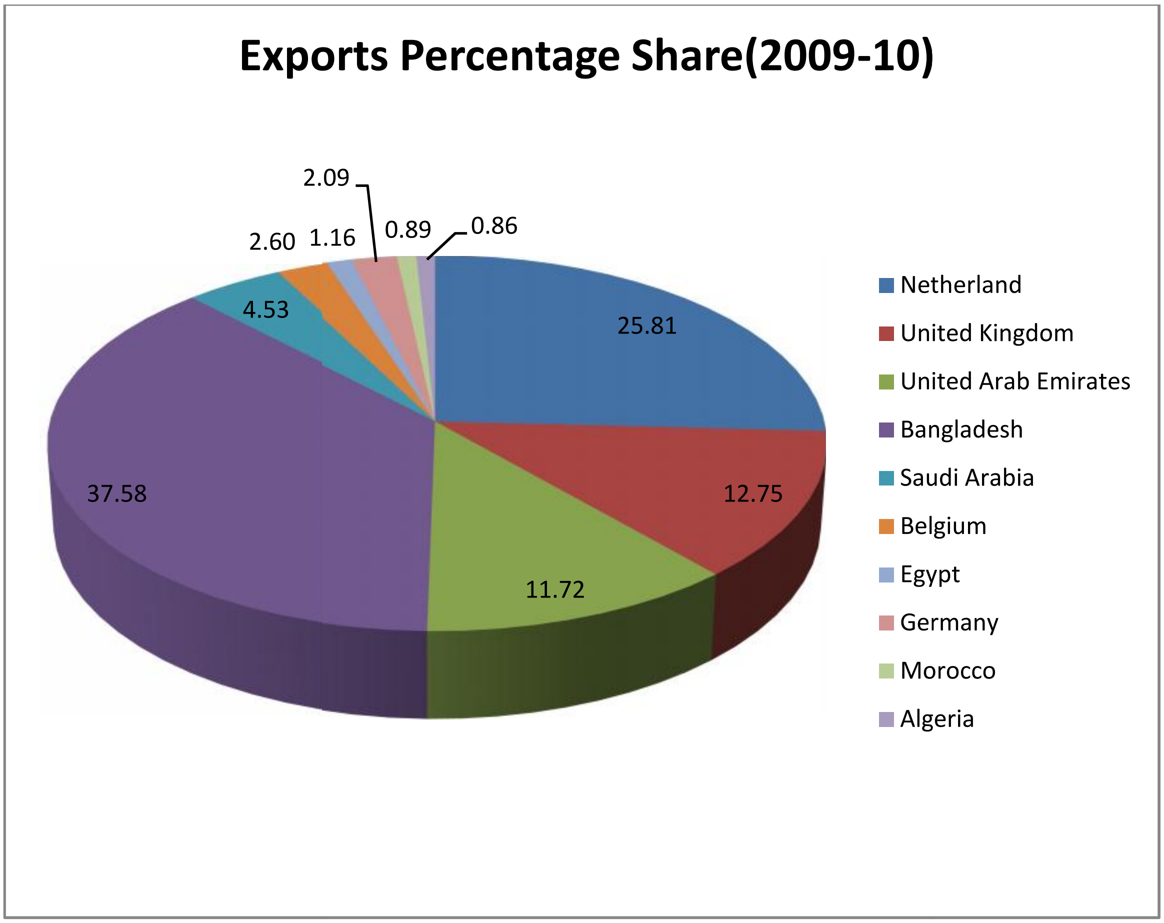

Fig. 5 : Indian Grape Export Destinations (2009-10)

Grape is a lucrative export commodity as is evinced by the figures in table 4.1 and 4.2. According to the table 4.2, in 2009, India's grape exports stood at Rs 4.09 billion (0.125 million tonnes) mainly to Bangladesh (38 per cent), Netherlands (25 per cent), the UAE (12 per cent) and UK (13 per cent). Other export destinations include Egypt, Belgium, Saudi Arabia, Germany and smaller quantities to nations in the Middle East. As a whole the EU forms a major importing block for Indian grape exports with Bangladesh and the Middle East being new growth areas.

It can be seen from the table 4.3 and subsequent graphs that, Maharashtra and Karnataka together contribute to approximately 78 per cent of total grape production in the country with Tamilnadu and Andhra Pradesh following far behind. However Maharashtra is still the undisputed leader when it comes to grape production clocking in at 440000 tonnes while Karnataka is a distant second at nearly 290000 tonnes.

Tables 4.4 and 4.5 show the grape area, production figures specific to Karnataka in greater detail. Bijapur and Chikkaballapura, the 2 valleys of Karnataka (Nandi and Krishna), hold the first and second position vis a vis production. The area under grape in state has fluctuated over the years but has shown an overall rise to approximately 15500 ha and a CAGR of 7.18 per cent while the production has nearly doubled in between the years of 2001-09 with a CAGR of 8.25 per cent.

Table 4.3 : Grape Producing States in India (2009-10)

State	**Production (in '000 tons)**	**Percentage Share**
Maharashtra	440.00	47.45
Karnataka	289.30	31.20
Tamilnadu	89.17	9.62
Andhra Pradesh	62.24	6.71
Punjab	15.47	1.67
Mizoram	13.74	1.48
Madhya Pradesh	12.5	1.35
Haryana	2.07	0.22
Himachal Pradesh	2.07	0.22
Jammu & Kashmir	0.54	0.06
Total	**927.10**	100

Source: APEDA, Indian Horticultural Board

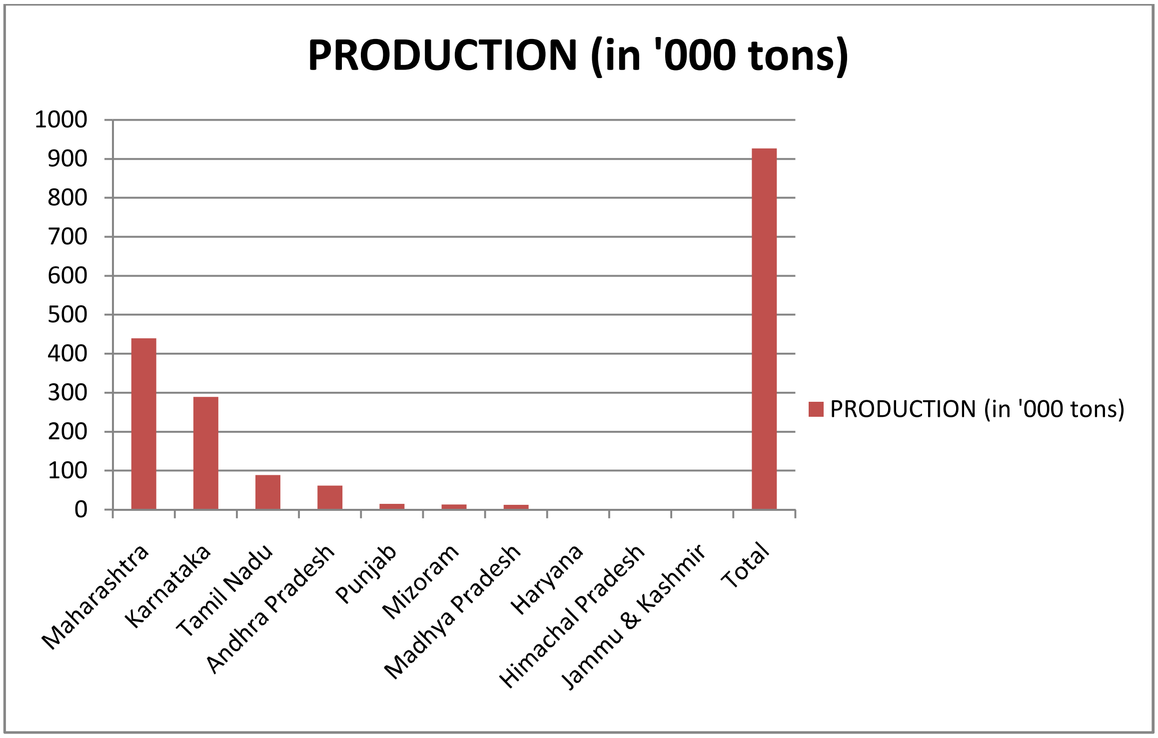

Fig. 6 : Grape Producing States in India (2009-10)

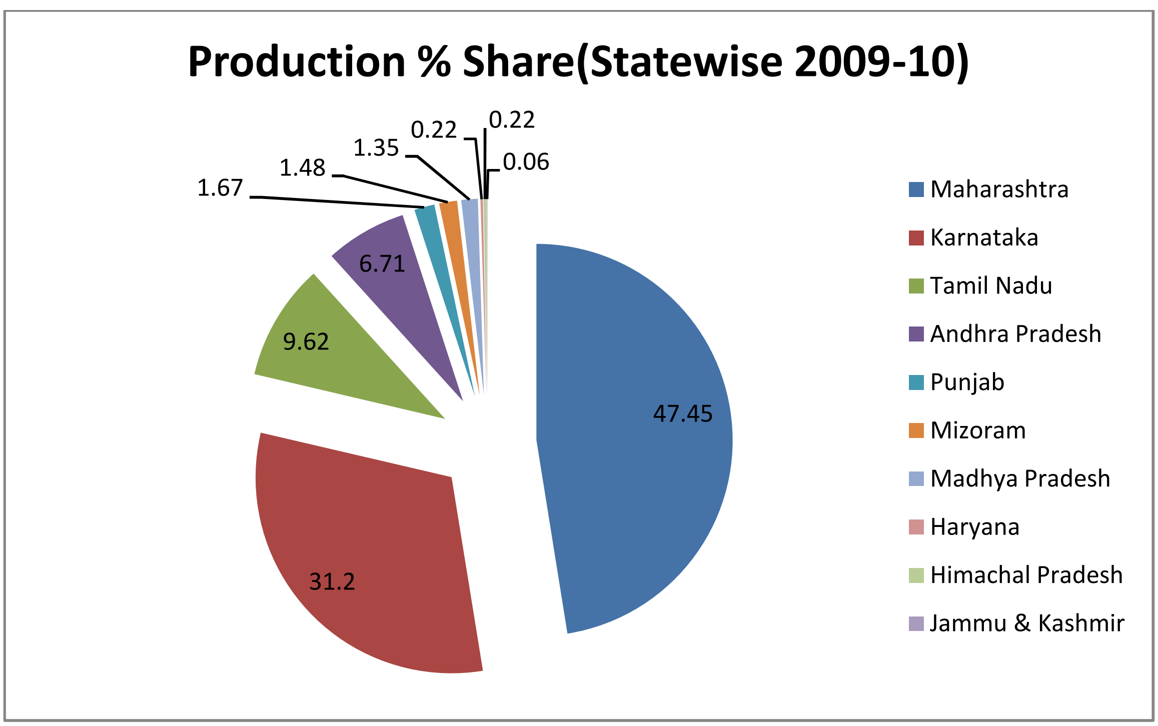

Fig. 7 : Grape Producing States in India (2009-10)

Table 4.4 : District wise area and production of grapes in Karnataka (2008-09)

District	Area in ha.	Production in Tonnes	Productivity in Tonnes/ha
Bangalore urban	808	17,410	21.55
Bangalore rural	1638	32,945	20.11
Chikkaballapura	2702	64,990	24.05
Chitradurga	13	195	15
Kolar	215	4266	19.84
Ramanagar	13	350	26.92
Tumkur	10	161	16.10
Bagalkote	1163	19,447	16.72
Belgaum	1313	22,019	16.77
Bijapur	6032	94,692	15.70
Dharwad	2	20	10
Gadag	60	525	8.75
Bellary	345	3000	8.70
Bidar	281	5620	20.00
Gulbarga	391	5567	14.24
Koppal	377	5936	15.75
Chikkamagalur	14	462	24.32
Hassan	6	90	15.00
Mandya	1	25	25.00
Mysore	12	240	20.00
Udupi	60	600	10.00
Total	**15,461**	**2, 89,300**	**18.02**

Source: Department of Horticulture, Government of Karnataka

Table 4.5 : Details of Area and Production of Grapes in Karnataka (2001-09)

Year	Area(hectares)	Production (Metric tonnes)
2001-02	10,035	1,69704
2002-03	9,721	1,67044
2003-04	9,103	1,70885
2004-05	10,138	1,85812
2005-06	10,273	1,90290
2006-07	12,080	2,16635
2007-08	14,310	2,58814
2008-09	15,461	2,89,300
CAGR	**7.18 %***	**8.25 %***

Source: Department of Horticulture, Government of Karnataka

*Significant at 5 per cent level

4.2 The technology gap and factors influencing pesticide usage pattern in grape production

4.2.1 The technology gap present with respect to pesticide usage in grape production

The various facets of the technological gap present in pesticide usage in grape production can be seen in the table 4.6. This study uses the NABARD classification to divide the farmers into 3 categories based upon the size of their land holdings. The number of farmers in each category who employed the recommended technologies in the correct manner is shown, as well as the percentage for each parameter. The deviation is measured against the package of practices for production of exportable table grapes recommended by the National Research Centre for Grapes, Pune and the pesticide storage, handling, safety guidelines given by the manufacturers on the label of the pesticide and those given by the National Vector Borne Disease Control Program, Directorate General of Health Services, Ministry of Health and Family Welfare.

For usage of correct chemicals with accuracy being judged on the basis of strength of chemical used in relation to the disease/pest attack faced, large farmers choose the correct chemicals with the highest accuracy (85%). As far as the dosage is concerned, fewest of the smaller farmers tend to use correct dose (30%) and under or over dosing is quite prevalent in other categories as well.(38.33% on the whole)

As regards to frequency, smaller farmers tend to spray more frequently, with fewer gaps between sprays, with only 45 per cent observing the correct time-period when compared to the medium (70%) and large (75%) farmers with 63.33 per cent on the whole. However there is almost no discernable difference when it comes to the technological gap for timing of the pesticide and chemical application with all three categories of farmers showing equivalent scores (85%-90%

Table 4.6 : Technological gap present with respect to pesticide usage

Sl. No.	Technology Gap Parameters	Large farmers (n=20)	Medium Farmers (n=20)	Small Farmers (n=20)	Total (N=60)
1.	Chemical Selection	16(85)	14(70)	11(55)	41(68.33)
2.	Dosage	9 (45)	8 (40)	6 (30)	23 (38.33)
3.	Frequency	15 (75)	14 (70)	9 (45)	38 (63.33)
4.	Timing	17 (85)	17 (85)	18 (90)	52 (86.67)
5.	Correct Storage/ Handling/ Disposal of Chemicals	6 (30)	5 (25)	5 (25)	16 (26.67)
6.	Usage of Proper Safety Measures and Equipment	4(20)	3(15)	0(0)	7(11.67)
7.	IPM Measures Employed	11 (55)	12 (60)	10 (50)	33 (55)
8.	Post Harvest Treatment Measures Employed	5 (25)	3 (15)	2 (10)	9 (15)

N.B : Values in parentheses indicate percentages.

Values are shown for correct usage of technology.

across categories and 86.67% on the whole). In regards to correct handling and disposal of chemicals and usage of proper safety equipment, the scores are abysmally low across the spectrum of farmers, ranging from 25-30 per cent for handling and disposal to 15-20 per cent for use of safety equipment (11.67% on the whole), with few farmers understanding the significance of using leak proof containers and proper cleaning of pesticide equipment and disposal of runoff to prevent leakage, spray drift, pesticide pollution and inadvertent human exposure to pesticide.

IPM (Integrated Pest Management) measures are however making steady inroads with almost 50-60 per cent (55% as a whole) farmers aware of certain forms of IPM like monitoring of fields, removal and proper disposal of diseased plant material, intercultural and pruning/training operations to remove weeds and pest alternative host plants, and speed up growth.

With regards to the post harvest treatment measures, which remain most cost effective technique of on-farm control of undesirable pesticide residues, by soaking, washing and cleaning and drying of produce, however most farmers are unaware of such measures and do not practice them with adoption levels ranging from 10-25 per cent.(15 % on the whole)

4.2.2 Reasons cited by farmers for not following recommended technological practices for pesticide usage

The reasons cited by farmers for not following recommended technological practices for pesticide usage are presented in table 4.7. It can be noticed from the table that cost of treatment considerations is paramount in the minds of smaller farmers with 70 per cent of them citing it as a reason behind their deviation with overall 53.33 per cent

Table 4.7 : Reasons cited by farmers for not following recommended technological practices for pesticide usage

Reason	Large Farmers (n=20)	Medium Farmers (n=20)	Small Farmers (n=20)	Total (N=60)
Cost Considerations	6 (30)	12 (60)	14 (70)	32 (53.33)
Lack of Knowledge/Training	13 (65)	13 (65)	12 (60)	38 (63.33)
Conflicting Advice from Peers/Dealers	7 (35)	7 (35)	8 (40)	22 (36.67)
Fear of Economic Damage to the Crop	4 (20)	4 (20)	5 (25)	13 (21.67)
Non availability of Recommended Chemicals/Equipment	8 (40)	10 (50)	12 (60)	30 (50)
Absence of incentive to change tried methods	1 (5)	2 (10)	3 (15)	6 (10)

N.B : Values in parentheses indicate percentages.

citing it as a reason. However for medium and large farmers, it is the lack of knowledge that prevents them from following the recommended practices with 65 per cent citing it as a reason.

Conflicting advice given by peers and dealers also plays a role in the decision making with 35-40 per cent farmers across categories citing this as one of the reasons for deviation from recommended practices (36.67% on the whole). Fear of economic damage to the crop motivates a small percentage of farmers (20-25% across categories, 21.67% on the whole) who believe the recommended package of practices to be inadequate and hence act on their own.

Non availability of recommended chemicals and equipment is a major cause for deviation from the norm, especially among smaller farmers with up to 60 per cent citing it as one of their reasons. Other categories of farmers also provide this reason but to a lesser degree (40-50%, 50% on the whole).

A small percentage (5-15%) of farmers, across all categories, cites absence of incentives and inertia as one of their reasons and refuses to alter methods which they have tried already.

4.2.3 Factors influencing pesticide usage pattern

Table 4.8 details the relevancy coefficient and relevancy ranking of various factors influencing pesticide and chemical usage in grape. The given 7 factors were ranked from 1-7 on a three point continuum viz "low", "medium", "high". The breakdown across the various farmer categories reveals that for the large farmers the most important considerations which affect pesticide usage pattern are mode of produce disposal i.e. whether the produce will be exported or sold domestically, intensity of disease/pest attack and economic considerations of cost of treatment. For medium size farmers the most important factors are

Table 4.8 : Factors influencing pesticide usage pattern

Farmer Category / Factors Affecting Pesticide Usage	Large farmers (n=20)		Medium Farmers(n=20)		Small Farmers (n=20)	
	Relevancy Coefficient	**Relevancy Rank**	**Relevancy Coefficient**	**Relevancy Rank**	**Relevancy Coefficient**	**Relevancy Rank**
Economic Considerations	.81	3	.90	1	.91	1
Dealer/Peer Recommendation	.71	6	.79	5	.82	4
Intensity of Outbreak	.87	2	.88	2	.88	2
Mode of Produce Disposal	.89	1	.76	6	.73	6
Information of Pest/Disease outbreaks in past 5 years	.69	7	.75	7	.70	7
Knowledge level of Farmer	.74	5	.81	4	.76	5
Credit Availability	.77	4	.83	3	.87	3

economic considerations of the treatment and associated losses, intensity of disease/pest attack and credit availability. The factors of mode of knowledge level of farmer and dealer/peer recommendation rank just below these on the totem pole. For small farmers, economic considerations are paramount in importance with the first rank, followed by the intensity of the disease/pest attack, degree of debt the farmer is carrying, recommendations from peers and dealers. Produce disposal is not a reason for these farmers to lose much sleep over.

4.3 Maximum residue level (MRL) information and degree of awareness for export markets.

4.3.1 Maximum residue level (MRL) information

The various MRL standards applicable to major export markets for most major classes of pesticides used in grapes are presented below.

India has a developed list of "insecticide" MRL levels that were established in 2010. "Insecticides," according to the Indian Insecticides Act of 1968, include all substances that are considered pesticides. The 2010 regulations are the result of the Food Safety and Standards Act of 2006 that cited the creation of specific MRL regulations. When no national Indian MRL exists, India will use Codex MRLs. The Food Safety Standards and Authority of India (FSSAI) published "Food Safety and Standards Regulations for 2010," which included MRL levels for pesticides for 2010. This updated a list of MRL levels that was in The Prevention of Food Adulteration Act & Rules of 2004. [Refer Annexure II]

Currently our national legislation covers a maximum of 149 chemicals across various food categories in comparison to Codex standards which cover 66 chemicals for grapes specifically and EU standards which cover 171 chemicals for control for just grapes. [Refer Annexure II]

In addition to MRL standards, many export markets now require certification of farming processes as being sustainable and non-damaging to the environment i.e GAP certified. For example E.U. requires GLOBALGAP certification for farm products exported to EU

4.3.2 Degree of awareness regarding export markets

The degree of awareness of farmers regarding export procedures, certifications and market requirements is catalogued in their responses to various parameters related to export knowledge in the table 4.9.

Unsurprisingly the table reveals that large farmers score higher than other famers in all categories, even the MRL information subject matter where poor scores seem to be the norm (16.67% overall). GAP certification and information category scores a little better with scores up to 50 per cent. Grade specifications of product for export parameter scores quite highly with scores ranging from 60-85 per cent.

However small farmers show a severe gap in their knowledge with respect to export procedure documentation and certification, traceability norms, payment terms and contract terminology and residue testing and sampling practices where scores are zero i.e none of the respondents surveyed were competently informed on the subject or were totally ignorant in some cases. Other farmer categories also show abysmal levels of knowledge on these parameters with a max percentage of 55 per cent. This scenario holds true for phyto-sanitary certification and knowledge of excise and customs procedures (pre shipment and post shipment). In regards to APEDA and DGFT registration and issuance of import-export code, larger farmers are well aware of the crucial nature of these agencies with 80 per cent being aware of their schemes, especially APEDA. Smaller farmers are aware of APEDA and DGFT to a lesser degree (20%-60%).

Table 4.9 : Degree of awareness regarding export markets

Export Knowledge Parameters	Large Farmers (n=20)	Medium Farmers (n=20)	Small Farmers (n=20)	Total (N=60)
MRL Standards	8 (40)	2 (10)	0 (0)	10 (16.67)
GAP Certification Information	10 (50)	8 (40)	5 (25)	23 (38.33)
Grade Specifications	17 (85)	15 (75)	12 (60)	44 (73.33)
Export Procedure Documentation and Certification	10 (50)	9 (45)	0 (0)	19 (31.67)
Traceability Norms	11 (55)	6 (30)	0 (0)	17 (28.33)
Payment terms and Contract Terminology	7 (35)	3 (15)	0 (0)	10 (16.67)
Residue Testing and Sampling Practices	9 (45)	4 (20)	0 (0)	13 (21.67)
APEDA and DGFT Registration	16 (80)	12 (60)	4 (20)	32 (53.33)
Phyto-sanitary Certification	7 (35)	6 (30)	0 (0)	13 (21.67)
Excise and Customs Procedure	5 (25)	2 (10)	0 (0)	7 (11.67)

N.B : Values in parentheses indicate percentages.

decade was high in China, India, Australia, Egypt, Chile, Iran, and USA, whereas it was negative to low in traditionally important countries, such as Italy, Spain, France, Germany, Greece and Turkey.

As is seen in the Table 4.1 and the figures 1-4, grape has proven to be a valuable horticultural commodity with its national production increasing by a CAGR of 6.54 per cent and area under cultivation growing by a CAGR of 6.61 per cent for the period of 2001-09. The exports of grapes have increased meteorically with the quantity exported showing a CAGR of 35.50 per cent and value of exports going up by 30.70 per cent for the period of 2001-09. These findings can be attributed to a number of factors which are making Indian grape cultivation and export enterprise a success story. These factors include the fact that our grape growing and arrival season offers us a window of opportunity during Feb-April in the fact that none of the major producers can send their produce to the market during this period, and the fact that while 70-80 per cent world production is consumed for wine making purposes, 85 per cent of Indian grape production is used for table purposes, a difference in consumption pattern that allows us ample product quantities for export purposes, and the fact that not only new markets beyond EU are being discovered for grape exports like Israel, Iraq etc, but that farmers are getting better returns. For example a tonne of grape exported in 2001 fetched approx 2.43 lakh Rs in value whereas the same export in 2008-09 fetched approx 3.05 lakh Rs. Additionally there still remains a huge potential for grape markets, both domestically and internationally. We currently export approximately 6.64 per cent of our grape output and form 1.3 per cent of global grape exports.

As the table 4.2 and fig no. 5 depicts, major export destinations circa 2009-10 have included EU members like, Netherlands (25%), and UK (13%); however the Middle East and the Gulf with destinations like the UAE (12%) and newer discoveries like Iraq, Israel have reoriented focus from traditional mass quantity but low quality markets like Bangladesh (38%). This also shows that our grape exports are highly dependent on a few traditional markets. It can be postulated that that the original high prices received in these markets created the first export opportunities in the Indian grape production sector and the early first mover advantage still applies to exporters who export to these markets, making them more willing to focus on these established markets rather than chart out risky, virgin territory.

It can be seen from the Tables 4.3, 4.4 and the figures 6-7 that Indian grape production is highly concentrated in nature with Maharashtra and Karnataka together contributing approximately 78 per cent of total grape production in the country with Tamilnadu and Andhra Pradesh following far behind. Even in Karnataka there is a concentration of the grape growing regions in 2 valleys namely the Nandi and the Krishna Valleys with Bijapur and Chikballapura districts being the top 2 producers of grapes. The state shows a CAGR of 7.18 per cent for the area under grape cultivation and a CAGR of 8.25 per cent for total production during the period of 2001-09. This concentration can be attributed to the fact that grape production that requires substantial investments, and extension support and agricultural infrastructure and marketing linkages in order to be a profitable enterprise and the right mix of these factors is along with the appropriate agro-climatic conditions can be found to the best extent in these 2 states.

5.2 The technology gap and factors influencing pesticide usage pattern in grape production.

5.2.1 The technology gap present with respect to pesticide usage in grape production.

The various facets of the technological gap present in pesticide usage in grape production exhibits the number of farmers, across various categories, who correctly follow the recommended package of practices for a given parameter. For the parameter of chemical selection, the higher accuracy exhibited by larger farmers in choosing correct chemicals, applying the right dosage and maintaining the correct frequency of sprays, compared to medium and smaller farmers, can be attributed to the fact that they are better informed, have more sources of knowledge and actually care about the other consequences of pesticide and chemical usage i.e. residues etc because they are more likely to dispose their crop through export, a marketing channel where pesticide usage and traceability are important issues. Thus larger farmers are less likely to use a hammer to kill an ant ie use heavy duty pesticides and chemicals to cure less severe disease/pest attacks than smaller farmers, who relying on input dealers advice use the strongest chemicals repeatedly in high dosages with quick repetitions to contain the disease/pest quickly but reduce the overall cost of treatment and save their crops to the greatest extent possible Most farmers are also unaware of the correct method of preparation and application of the pesticide formulation and lack the necessary measuring equipment, resulting in incorrect concentration and dosage. However on the issue of timing of application, the difference between various categories narrows down significantly as almost all farmers are experienced enough to recognize symptoms of the pest/disease and act in time to save their crops.

The real lacunae in the knowledge level of the farmers reflected as a technological gap is however witnessed in the parameters of correct handling, application, storage and disposal of pesticides and possession and utilization of proper safety equipment (26.67% and 11.67%). On either of these parameters, famers across all categories score poorly, a phenomenon which can be attributed to the facts that there is little stress placed on these area during extension programs, there is a cavalier and lackadaisical attitude prevalent amongst farmers due to their ignorance about long term health issues created by unsafe exposure to pesticides and the additional labour and equipment cost inherent in adding the safety factor to pesticide and chemical usage means most farmers deem it prudent to save some money in this area.

IPM (Integrated Pest Management) is followed on a limited scale by approximately half of the farmers (55%) and the fact that its full potential remains unutilized can be explained by the presence of a bevy of limiting factors which include ignorance, illiteracy, and the intrinsic nature of IPM which is a long term action plan to reduce economic injury to crop, a fact that most farmers fail to grasp when they are under the stress of seeing their crop being lost due to pest attack in front of their eyes.

Post harvest treatment measures, the simplest way to reduce spoilage and losses and sharply reduce the amount of pesticide residues remaining on the crop. Studies suggest these measures, some as simple as repeated washing of the crop, may be highly effective in reduce pesticide and chemical residues (Elkins 1989), however awareness level among farmers regarding these practices is quite low (15% on the whole), with a odd farmer out of multitudes aware of these practices, even for farmers who seek to export their produce. This can readily be explained by the reason that hitherto these practices have been ignored by extension policy makers in India, who have been focused on increasing production and combating pest/disease attacks till now.

5.2.2 Reasons cited by farmers for not following recommended technological practices for pesticide usage.

The results shown in table 4.7 reveal that cost considerations are foremost in the minds of small farmers, when it comes to usage of correct pesticides in correct dosages. These may be in the form cost of treatments (70% cite this as one of the reasons) which leads them to dose heavily in as few treatments as possible to reduce overall cost and crop losses (25% cite this as one of the reasons). Medium sized farmers are quite susceptible to cost trap too with 60 per cent citing it as one of their reasons and 53.33 per cent farmers cite this as one of their reasons on the whole. This can be attributed to the nature of grape vines which being a permanent presence in the fields are affected by a number of biotic and abiotic stresses and need correct detection and regular application of growth regulator and plant protection chemicals to ensure health and productivity, especially as vines age and become more susceptible to such stresses. In fact studies in the EU estimate that despite accounting for 3.5 per cent of the total EU agricultural area, grapes receive around 15 per cent of the synthetic pesticides (active substances) applied to major crops (European Commission (2007)) and that plant protection cost component to form 40 per cent of the cost of cultivation of grape (KOSTADINOV et al., (2008)). NABARD also recognizes this in the fact that grape is perhaps the only crop in India which is not usually grown by any farmer without recourse to bank credit.

Lack of knowledge and training is cited by a large majority of farmers cutting across all categories with 63.33 per cent in total as one of the reasons behind the prevalence of technological gap. This can readily be attributed to the fact that extension efforts focused on grape production, especially for crop for export purpose are few and far between, with most of the efforts focused on increasing production and maintaining grade specifications. There is a severe absence of any knowledgebase about the pesticide and chemical usage do's and don't's and appropriate testing and measuring equipment with the primary extension source of farmers being local input dealers and grape growers association. This trend is also bolstered by the current understaffing of the Department of Horticulture, Karnataka, when compared to the Department of Agriculture, and the low training and knowledge levels of workers in respect to current scientific advances in horticulture and specifically grape cultivation for exports, especially at the taluka levels,. This has created a sense of resignation amongst grape farmers because their lack of knowledge robs them of any opportunity to export their product and has led to a general disenchantment with the hassles of the exporting process with growing number of farmers diverting their produce to the domestic market.

For a large number of respondents among the small farmers, advice from their peers and input dealers form the main information source for the decision-making process on their farms. Thus conflicting information from these sources is cited by almost 40 per cent of such famers as a reason for their deviation. Larger farmers, with greater resources and higher knowledge and literacy levels, have access to a greater number of information sources including official extension resources and genuine research material, and thus depend less on advice which may be biased by conflict of interest, a fact seen in the lower number of such farmers citing conflict of advice as a reason for their deviation from the recommended package of practices.

Non availability of recommended chemicals and equipment also appears to be a limiting factor, especially for small farmers (60%) and medium farmers (50%).This can be understood by the fact that all farmers, especially small and medium farmers are dependent to a greater extent upon supplies and equipment available in the vicinity of their landholding and few farmers have the time and resources to obtain needed farm input supplies from great distances.

A small minority of farmers (10% on the whole) refuses to change their tried and tested methods of cultivation. This can be understood by the traditional mores of the farmers who want definitive proof before abandoning methods which they perceive to be adequate and incurring additional costs.

5.2.3 Factors influencing pesticide usage pattern

Table 4.8 exhibits the various factors influencing pesticide usage behavior among the 3 categories of farmers and their relevancy rankings.

Mode of produce disposal is the first factor affecting pesticide usage among large farmers while it only ranks sixth among the medium and small farmers, observations that can be explained by the fact that the only grape production intended for export, a marketing channel where usage pattern of pesticide is important and quantified, is concentrated in the hands of the large farmers, while the rest of the farmers dispose their produce in the local APMC or raisin making units and thus have to qualify only for Indian MRL standards, which are much lower than export specifications.

Economic considerations which include cost of treatments and resulting crop loss due to pest/disease attack are foremost in the minds of the medium and small farmers while using pesticides and ranked third for the larger farmers. This can be readily attributed to the heavy pesticide consumption of grape crop. Studies in EU indicate that though grape occupies only 3 per cent of the area, it consume approximately 20 per cent of the total pesticide consumption and thus has huge costs in chemical outlays an important decision influencing factor even for the larger, more financially secure farmers.

The intensity of disease/pest attack is a common factor across all farmer categories and can be readily understood as being directly related to the decision making process of pesticide usage.

Credit availability is a crucial factor affecting pesticide usage among small and medium farmers and to a lesser extent among large farmers. This can be understood by the reasoning that NABARD has identified grape as a crop that is almost exclusively grown with the help of credit support due to its heavy investments and long gestation period and annual maintenance costs. Credit for grape production is available more easily to large grape farmers and producers than to the smaller producers, who thus accord it a greater degree of importance.

Dealer and peer recommendations also play an important role in influencing pesticide usage ranking in the 4^{th}-6^{th} position across the various farmer categories, an observation that is justified by the severely limited presence of formal extension workers creating a situation where main information sources for farmers regarding the recommended cultivation practices and marketing information for grapes is filled by these two groups. However large farmers are less likely to rely on this advice compared to small and medium farmers, as they have access to alternative, trusted information sources an

Information of pest/disease attack in the past 5 years seeks to collect and collate any and all information about previous pest/disease attacks and help develop a pattern for the various pest/disease attacks.

This type of information gathering and its impact is under estimated by farmers across all 3 categories with very few keeping extensive records and basing their decisions on the gathered information. This can be attributed to the fact the nature of help provided by such measures is in the form of intelligence and long term in benefits, so very few farmers can effectively gauge its impact. Additionally high levels of illiteracy lead to impaired skills and difficulties in information gathering.

Knowledge level of farmers plays an important role in the decision making process about pesticide usage as is evidenced by 4^{th}-5^{th} ranks given to this variable in the rankings. The obvious conclusion that can be inferred from this observation is that there is a lack of formal extension support and it forces farmers to rely on their own resources to ensure optimal grape cultivation and production.

5.3 Maximum residue level (MRL) information and degree of awareness for export markets.

5.3.1 Maximum residue level (MRL) information

Pesticide and chemical residues are not just caused due to direct spray but can be caused by pesticide spray drift and indirect seepage from nearby fields. This is the part where GAP (Good Agricultural Practices) and proper knowledge and training in application and disposal of pesticides comes into play to create a sustainable farming system which allows farmers to control pests, diseases and apply plant growth regulators in tandem with understanding the efficacy and breakdown cycle of these chemicals ensuring that resultant produce complies with all applicable food safety and MRL norms. There exists a severe gap between the MRL norms prescribed by Indian legislation and those prevalent in export markets both in the form of chemicals covered and MRL tolerances, because prescribed in the Indian MRL limits are significantly higher than those of EU or other export markets for agri-commodities.

This has been used as a technical barrier to trade in the past by the developed countries but this gap is probably created as a result of the changing mindsets of consumers across the world, who are now demanding quality and safety in their food in addition to quantity and are willing to pay a premium for the assurance reflected in high prices commanded by organically grown food. Thus there has been a greater disparity between the acceptable dietary intake and safety limits prescribes by developed nations and the food safety laws of developing countries who have till recently relied heavily on massive dosages of heavy duty unsafe pesticides to ensure adequate levels of food production for their burgeoning populations. However, there is a price to be paid for this victory won by chemicals in the form of spiraling health crisis and harmful externalities in the form soil, water and air pollution. Thus the dilemma of ensuring food safety in tandem with food availability requires a holistic approach covering all aspects of pest/disease management in conjunction with the residue monitoring (e.g. GRAPENET) and food processing aspects of food safety. Better pesticides, IPM, impeccable traceability, improved food processing techniques are all part of the solution to this puzzle.

5.3.2 Degree of awareness regarding export markets

When it comes to knowledge about export market requirements and procedures to be followed, there seems to be a severe gap in the knowledge level of farmers. This is hardly surprising because even though KAPPEC has set up a cold storage in Bijapur to promote exports, government efforts in export promotion and information seem to fragmented and disjointed, as proven by 15-20 odd container grapes exported from whole Bijapur while Indian exports are approximately

4000 containers annually. Larger farmers are the most well informed group according to the study even though they too present surpising degree of ignorance on several crucial matters.

On the factors of knowledge and degree of awareness regarding MRL standards information, export procedure and documentation, excise and customs procedure, phyto-sanitary certification, residue testing and sampling practices, payment terms and contract terminology and traceability norms, smaller farmers are completely oblivious, while medium size farmers also show limited knowledge levels (maximum awareness levels 45%). In comparison larger famers are significantly better informed. This phenomenon can be explained by the fact that it is the larger famers exclusively who seek out and export to foreign markets and thus acquire this knowledge and even exporting agencies sourcing grapes prefer to deal with the large farmers to get the volumes they need.

When it comes to knowledge related to grade specifications, farmers are surprisingly knowledgeable across the categories, a observation which may be explained by the recent spurt in sourcing of grapes by modern retail chains who insist on grading of produce.

In respect to GAP certification information, there is a ray of hope with a good number of farmers aware of the need for these certificates, if not the procedure and the requirements. This trend is probably be an offshoot of the spread of GLOBALGAP certification agencies and their drive to certify farmers in the grape growing districts of the nearby state of Maharashtra. On the factor of knowledge about APEDA and DGFT and the registration requirements, most famers are aware of APEDA and have heard about some of its initiatives, but the knowledge is of a distant sort. This is probably due to the lack of a dedicated knowledge channel for grape production and export schemes, like the ones that exist in Maharashtra under the aegis of National Research Centre for Grapes.

5.4 Suitable corrective strategies to meet export standards.

From the results compiled so far, it is quite clear that most of the problems of grape farmers in accessing export markets stem from a lack of knowledge, equipment and training, a trio of factors which coupled with lack of agricultural infrastructure, low credit availablility, absence of market information and strict food safety norms required by international markets creates a situation where most farmers have given up on export markets. To correct this situation, this study suggests the following measures:

1. Creation of a dedicated extension channel under the state department of horticulture to inform and train farmers about export market requirements and technology needed to obtain optimal yields.
2. Provide a greater degree of credit support and single window clearance mechanism for grape export purposes.
3. Lower the cost of plant protection, with greater focus on IPM and safer technologies to ensure compliance with MRL standards of any market without affecting returns.
4. Widely spread grape technology and testing centers, to allow farmers access to latest research and subsidized residue testing facilities, a process that requires them to travel long distances and pay high costs currently.
5. Retool national MRL standards legislation to bring it on par with the latest threat perception studies of chemical usage.
6. Improve processing facilities to reduce residue levels in the product and increase the degree of value addition.
7. Implement technical measures like GRAPENET at a wider level to improve traceability and supply chain visibility.

SUMMARY &
POLICY IMPLICATION

CHAPTER VI

SUMMARY AND POLICY IMPLICATIONS

Indian agriculture sector is at a cross roads. The Faustian bargain of the green revolution using agro-chemicals liberally to drive up production in conjunction with improvements in plant varieties had a price and the bill has started to come due. Our lands and water bodies are being degraded and polluted at an increasing pace, soil C:N balance has become dangerously lopsided and our produce is losing quality in terms of nutrition, taste etc. It is time for us recognize the dangers inherent in overreliance on agrochemicals as a panacea for all our problems and treating our farmlands as a simple production mechanism rather than the complex biosystems they are.

In addition to the loss of agricultural productivity, our chemical tainted produce is creating a hidden but ever increasing health crisis among both our producers and consumers. With the developed world focusing more and more on food safety and sustainability in agricultural practices, we are in the danger of losing export markets for our produce as well with high level of pesticide residue in commodities creating a situation where more than Rs. 4000 crores worth of Indian exports are rejected every year.

Grape, with an estimated global production of 67.7 million tonnes in 2008-09, is grown in about 90 countries around the world covering an area of 7.5 million ha with an average global productivity of 9.1 tonnes per hectare. It is an important commercial fruit crop of India which contributes to the maximum share of export of fresh fruits and vegetables from India to Europe and other parts of the world. India is 12th largest grape producing country in the world with the highest productivity. During the year 2008-09, the crop was grown in an area of 79,600 hectares, with a production of 1.87 million tonnes and productivity of 26.2 tonnes per hectare. Though, grape occupies only 1 per cent of the total area under fruits, it contributes to about 2.7 per cent of the total fruit production of the country and is considered as a high value horticultural commodity with exports a marginal volume of total grape output constituting about 1.3 per cent of the world's total grape exports. In 2009, India's grape exports stood at Rs 4.09 billion (0.125 million tonnes). The area under this fruit has increased by 50 per cent and its production by 71 per cent in the country in the last decade (1994-2004), mainly due to its economic importance. However it too is a commodity affected by the controversies regarding food safety and sustainability with exports to EU falling by 50 per cent in 2010.

This study aims to bridge the gap in the knowledge of farmers by providing an insight into the knowledge level of our grape cultivators, factors associated with agrochemical usage, and compiling the various international export standards contrasted with national standards for handy reference by studying grape cultivation in Bijapur district with the following objectives:

- To document grape production, export and destination.
- To study the technology gap and factors influencing pesticide usage pattern in grape production
- To study maximum residue level (MRL) information and degree of awareness for export markets.
- To suggest suitable corrective strategies to meet export standards.

Bijapur district was specially selected for the study because the district is at the forefront of grape production in terms of area and production in Karnataka, the second largest grape producing state in the country.

Primary data regarding pesticide usage, exporting knowledge, MRL awareness and associated factors was collected by interviewing farmers and input dealers of Bijapur district using a pre-prepared schedule. Secondary data regarding area, production and export of grapes was collected from APEDA, Department of Horticulture of Karnataka, Ministry of Commerce, and Indian Horticultural Database.

Compound annual growth rate (CAGR) is an average growth rate over a period of several years. CAGR technique is used to analyze the growth rate of the grape area, production and export over the years.

Tabular analysis is extensively used to study pattern of grape production, trade, technological gap in grape production, reasons for the gap and degree of awareness for export markets.

Relevancy Ranking was the tool used to rate factors which influence pesticide usage behavior and rank from first to seventh rank was given to factors. The ranking for the factors was on a three point relevancy continuum

MAJOR FINDINGS OF THE STUDY

1. Indian grape area, production and exports (quantity and value) have shown significant growth in the recent years.(6.61 %, 6.54%, 35.50% and 30.70% respectively)
2. Grape production (78.65% in 2 states) and export (87.86% to four destinations) is highly concentrated in nature.
3. There is a significant percentage (ranging from 13.33%-88.33% across various parameters) of farmers both large and small afflicted by some level of technology gap in the matter of plant protection measures.

4. Major areas of technology gap include employment of proper safety measures and equipment (88.33%), preparation, storage, usage and disposal of chemicals (73.33%), IPM (45%), and employment of post harvest treatment measures (85%).
5. Primary reasons behind technology gap are economic considerations (53.33%), lack of knowledge/training on part of farmers (63.33%), non availability of correct chemicals and equipment (50%).
6. Farmers pesticide usage pattern is affected mainly by intensity of disease/pest attack and economic considerations.
7. There is a significant gap between Indian MRL standards and MRL standards adopted by USA and EU in terms of chemicals covered and safe dosage prescribed.
8. Small and medium farmers exhibit a very low level of knowledge regarding exporting procedure and export market requirements, especially in comparison to large farmers.

POLICY IMPLICATIONS & SUGGESTIONS

1. Grape production and export is highly concentrated and any disruption in these areas can significantly impact total production and export. It is therefore suggested to seek out new areas for grape cultivation and new markets for grape exports to reduce the vulnerability of grape production and export industry.
2. Technology gap in plant protection measures in grape production is largely predicated on the absence of an effective extension network to train and educate the producers and economic considerations. Therefore it is suggested to create a dedicated extension channel with physical and electronic infrastructure for grape producers to help them produce quality grapes for export by providing them access to latest technological know-how, subsidized inputs, equipment and

latest market information while improving traceability.(GRAPENET can be a starting point) It can be created on a PPP model with large export houses acting in concert with the Government, APEDA and Department of Horticulture and other institutions.

3. There is a severe lacuna in the knowledge level of farmers regarding safe handling, application, storage and disposal of pesticides, and poor levels of awareness and compliance with safety measures and usage of proper safety equipment. It is therefore suggested that proper educational efforts to rectify this situation be expedited.
4. Pesticide usage pattern of the farmers is mainly shaped by disease attack and economic considerations i.e. it focuses on the cheap short term cure. For more effective plant protection at lower economic, health and environmental costs on the basis that prevention is better than cure, IPM and other organic pest control measures can be promoted among grape farmers.
5. The substantial difference in EU and Indian MRL standards creates not only a barrier to trade but is creating an agricultural productivity and human health crisis by allowing heavy usage of chemicals and practice of unsustainable farming practices. It is therefore suggested that the National food safety legislation be brought in concert with international food safety norms to ensure that safe food is not only available for export, but is available to the general population.
6. Awareness amongst farmers regarding information about export procedure, certification information and market requirements is poor. It is therefore suggested to create a secondary channel of extension support at district level to deal directly with farmers and provide them with information and linkages for those interesting in exporting their produce.

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CHAPTER VII

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ANNEXURES

ANNEXURE - I

GLOSSARY

ADA	*Acceptable Dietary Intake Value*
APEDA	*Agricultural and Processed Foods Export Development Authority*
CAGR	*Compounded Annual Growth Rate*
DGFT	*Directorate General of Foreign Trade*
EU	*European Union*
IHD	*Indian Horticulture Database*
MRL	*Maximum Residue Limits*
NABARD	*National Bank for Agricultural and Rural Development*
NHB	*National Horticulture Board*
NRC	*National Research Centre For Grapes*
REACH	*Registration, Evaluation, Authorization and Restriction of Chemical substances*

ANNEXURE – II

CODEX Alimentarius MRL Standards for Table Grapes

Pesticide	MRL Value (mg/kg)	Pesticide	MRL Value (mg/kg)
ALDICARB	0.2	FENHEXAMID	15
AMITROLE	0.05	FENPROPATHRIN	5
AZOCYCLOTIN	0.3	FLUDIOXONIL	2
BENALAXYL	0.2	FLUSILAZOLE	0.2
BIFENAZATE	0.7	FOLPET	10
BOSCALID	5	HALOXYFOP	0.05
BROMOPROPYLATE	2	HEXYTHIAZOX	1
CAPTAN	25	IMIDACLOPRID	1
CARBARYL	5	INDOXACARB	2
CARBENDAZIM	3	IPRODIONE	10
CHLOROTHALONIL	0.5	KRESOXIM-METHYL	1
CHLORPYRIFOS	0.5	MALATHION	5
CHLORPYRIFOS-METHYL	0.2	METALAXYL	1
CLOFENTEZINE	2	METHIDATHION	1
CYCLOXYDIM	0.5	METHOMYL	5
CYHEXATIN	0.2	METHOXYFENOZIDE	1
CYPRODINIL	3	MYCLOBUTANIL	1
DELTAMETHRIN	0.2	PARATHION-METHYL	0.5
DICHLOFLUANID	15	PENCONAZOLE	0.2
DICOFOL	5	PHOSMET	2
DIFENOCONAZOLE	0.1	PROCYMIDONE	10
DIMETHOMORPH	2	PROPARGITE	5
DINOCAP	0.5	PYRACLOSTROBIN	7
DITHIANON	3	PYRIMETHANIL	2
DITHIOCARBAMATES	5	QUINOXYFEN	4
ETHEPHON	1	SPINOSAD	2
FAMOXADONE	2	TEBUCONAZOLE	0.5
FENARIMOL	0.3	TEBUFENOZIDE	2
FENBUCONAZOLE	1	TOLYLFLUANID	2
FENBUTATIN OXIDE	5	TRIADIMEFON	3

European Union MRL Standards for Table Grapes

Sl. No.	Chemicals	Harmonized EU-MRL (mg/kg) updated on 11th October	Status in EU under Directive 91/414/EEC
I)	**Organochlorine**		
1.	Aldrin (Aldrin and dieldrin combined expressed as dieldrin)	0.01*	Out/Banned
2.	Chlordane (cis & trans)	0.01*	Out/Banned
3.	**Chlorothalonil****	**1.00**	**In**
4.	DDT (all isomers, sum of p,p´-DDT, o,p´-DDT, p,p´-DDE and p,p´-TDE (DDD) expressed as DDT)	0.05*	Out/Banned
5.	**Dicofol** (sum of p, p´ and o,p´ isomers)**	**2.00**	**Out/Substance fulfilling criteria Annex VI Reg 1490/2002**
6.	Dieldrin (see Aldrin)	0.01*	Out/Banned
7.	Endosulphan (All isomers, sum of *alpha*- and *beta*-isomers and endosulphan sulphate expressed as endosulphan)	0.50	Out
8.	Endrin	0.01*	Out/Banned
9.	HCH (sum of isomers, except the *gamma* isomer)	0.01*	Out/Banned
10.	Heptachlor (sum of heptachlor and heptachlor epoxide expressed as heptachlor)	0.01*	Out/Banned
11.	Lindane (*gamma*-HCH)	0.01*	Out
II)	**Organophosphorus**		
12.	4-bromo-2-chlorophenol (metabolite of Profenophos)	0.01	Out
13.	Acephate	0.02*	Out
14.	Chlorfenvinphos	0.02*	Out/Essential use 835/2004
15.	**Chlorpyrifos****	**0.50**	**In**
16.	Chlorpyrifos methyl	0.20	In
17.	Diazinon	0.01*	Out
18.	Dichlorvos	0.01*	Out
19.	Dimethoate (Including Omethoate)	0.02*	In
20.	Edifenphos	0.01	Out/ Never notified and authorized in the EU
21.	Ethion	0.01*	Out/Essential Use
22.	Etrimfos	0.01	Out

Sl. No.	**Chemicals**	**Harmonized EU-MRL (mg/kg) updated on 11th October**	**Status in EU under Directive 91/414/EEC**
23.	Fenitrothion	0.01*	Out
24.	Fenthion (fenthion and its oxygen analogue, their sulfoxides and sulfone expressed as parent)	0.01*	Out
25.	Glufosinate-ammonium (sum of glufosinate, its salts, MPP and NAG expressed as glufosinate equivalents)	0.10*	In
26.	Glyphosate (and the metabolite aminomethylphosphonic acid)	0.50	In/ Extension of the expiry date for inclusion
27.	**Iprobenphos****	**0.01**	**Out/ Never notified and authorized in the EU**
28.	**Malathion** (sum of malathion and malaoxon expressed as malathion)**	**0.02***	**In**
29.	Methamidophos	0.01*	Out
30.	Monocrotophos	0.01	Out
31.	Omethoate (refer to Dimethoate)	0.02*	Out
32.	Oxydemeton- methyl (sum of oxydemeton methyl and demeton-S-methylsulfone expressed as oxydemeton methyl)	0.01*	Out
33.	Parathion ethyl	0.05*	Out
34.	Parathion methyl (sum of Parathion methyl and paraoxon methyl expressed as Parathion methyl)	0.02*	Out
35.	Phenthoate	0.01	Out
36.	Phorate (sum of phorate, its oxygen analogue and their sulfones expressed as phorate)	0.05*	Out
37.	**Phosalone****	**0.05***	**Out**
38.	Phosphamidon	0.01*	Out
39.	Pirimiphos-methyl	0.05*	In
40.	Profenophos	0.05*	Out
41.	Propetamphos	0.01	Out
42.	Quinalphos	0.05*	Out
43.	Temephos	0.01	Out
44.	Thiometon	0.01	Out
45.	Triazophos	0.01*	Out/Essential use
III)	**Synthetic Pyrethroids**		
46.	Allethrin and Bioallethrin	0.01	Out

Sl. No.	Chemicals	Harmonized EU-MRL (mg/kg) updated on 11th October	Status in EU under Directive 91/414/EEC
47.	Bifenthrin	0.20	Out/Application resubmitted for inclusion (Reg 33/2008)
48.	Cyfluthrin (including other mixtures of constituent isomers sum of isomers)	0.30	In
49.	Cypermethrin (including other mixtures of constituent isomers sum of isomers)	0.50	In (except beta isomer)
50.	Deltamethrin	0.20	In
51.	Ethofenprox (Etofenprox)	5.00	In
52.	Fenpropathrin	0.01*	Out
53.	Fenvalerate & Esfenvalerate (sum of RR & SS isomers)	0.10	Fenvalerate-Out Esfenvalerate-In/ Extension of the expiry date for inclusion (2010/77)
54.	Fenvalerate & Esfenvalerate (sum of RS & SR isomers)	0.02*	Fenvalerate-Out Esfenvalerate-In/ Extension of the expiry date for inclusion (2010/77)
55.	**Lambda-cyhalothrin****	**0.20**	**In/** Extension of the expiry date for inclusion (2010/77)
56.	Permethrin (sum of isomers)	0.05*	Out
57.	*tau*- Fluvalinate	0.10	In/Initially not included by decision 2008/934. Inclusion voted in Jan 2011 following resubmission for inclusion according to Reg. 33/2008
58.	Transfluthrin	0.01	Not Included
IV)	**Triazines**		
59.	Atrazine	0.05*	Out
60.	Flufenzine	0.10	Out
61.	Simazine	0.20	Out/ Essential use 835/2004
V)	**Acylamino acid fungicides**		

Sl. No.	Chemicals	Harmonized EU-MRL (mg/kg) updated on 11th October	Status in EU under Directive 91/414/EEC
62.	Benalaxyl including other mixtures of constituent isomers including Benalaxyl-M (sum of isomers)	0.20	Benalaxyl-In Benalaxyl-M-Pending
63.	**Metalaxyl ** & Metalaxyl-M**	**2.00**	Metalaxyl - In Metalaxyl –M-In/ Extension of the expiry date for inclusion (2010/77)
64.	Oxycarboxin	0.05*	Out
65.	Propanil	0.10*	Out/Application resubmitted for inclusion (Reg 33/2008)
VI)	**Carbamates**		
66.	Bendiocarb	0.01	Out
67.	Benfuracarb	0.05*	Out
68.	**Benomyl (see carbendazim)****	**0.30**	**Out/ Essential use 835/2004**
69.	**Carbaryl****	**0.05***	**Out**
70.	Carbofuran (sum of carbofuran and 3-hydroxy-carbofuran expressed as carbofuran)	0.02*	Out
71.	Carbosulfan	0.05*	Out
72.	Dazomet (Methylisothiocyanate resulting from the use of dazomet and metam)	0.02*	Out/ Application resubmitted for inclusion (Reg 33/2008)
73.	Fenobucarb	0.01	Out/ Never notified and authorized in the EU
74.	Indoxacarb (sum of R and S isomers)	2.00	In
75.	Iprovalicarb	2.00	In/ Extension of the expiry date for inclusion (2010/77)
76.	**Methomyl** and Thiodicarb (sum of methomyl and thiodicarb expressed as methomyl)**	**0.02***	**Methomyl-In Thiodicarb-Out**
77.	Propoxur	0.05*	Out
78.	Thiobencarb (Benthiocarb)	0.10*	Out
79.	Thiodicarb (see Methomyl)	0.02*	Methomyl-In Thiodicarb-Out
VII)	**Pyrimidines**		

Sl. No.	**Chemicals**	**Harmonized EU-MRL (mg/kg) updated on 11th October**	**Status in EU under Directive 91/414/EEC**
80.	Fenarimol	0.30	Out
VIII) Triazoles			
81.	Bitertanol	0.05*	Out/ Application resubmitted for inclusion (Reg 33/2008)
82.	Difenoconazole	0.50	In
83.	**Flusilazole****	**0.05**	**In**
84.	**Hexaconazole****	**0.10**	**Out**
85.	**Myclobutanil****	**1.00**	**In/Initially non included by decision 2008/934. Inclusion voted in Nov 2010 following resubmission for inclusion according to Reg. 33/2008**
86.	Paclobutrazol	0.05	Out/ Application resubmitted for inclusion (Reg 33/2008)
87.	**Penconazole****	**0.20**	**In**
88.	Propiconazole	0.05*	In
89.	Tebuconazole	2.00	In
90.	**Triadimefon **(sum of triadimefon and triadimenol)**	**2.00**	**Triadimefon-Out Triadimenol-In**
IX) Imidazole			
91.	**Fenamidone****	**0.50**	**In**
92.	**Iprodione****	**10.00**	**In**
X) Oxazole			
93.	Famoxadone	2.00	In/ Extension of the expiry date for inclusion (2010/77)
XI) Phthalimide			
94.	Captafol	0.02*	Out/Banned
95.	**Captan****	**0.02***	**In**
XII) Benzimidazole			
96.	**Carbendazim (including Benomyl)****	**0.30**	**Carbendazim – In/ Approved with**

Sl. No.	Chemicals	Harmonized EU-MRL (mg/kg) updated on 11th October	Status in EU under Directive 91/414/EEC
			restrictions to crops and application rates Benomyl- Out/Essential use 835/2004
97.	Thiophanate-methyl	0.10*	In
XIII) Dithiocarbamates			
98.	**Dithiocarbamates (Mancozeb**, Maneb, Propineb**, Metiram, Thiram, Zineb** and Ziram** collectively estimated as CS2)**	**5.00**	**All In except Zineb**
XIV) Nicotinoids			
99.	Acetamiprid	0.01*	In
100.	**Clothianidin (see thiamethoxam)****	**0.60**	**In/Additional provisions to protect honey bees introduced by Directive 2010/21/EU**
101.	**Imidacloprid****	**1.00**	**In/Additional provisions to protect honey bees introduced by Directive 2010/21/EU**
102.	Thiacloprid	0.02*	In
103.	**Thiamethoxam (sum of thiamethoxam and clothianidin expressed as thiamethoxam)****	**0.50**	**In/Additional provisions to protect honey bees introduced by Directive 2010/21/EU**
XV) Dinitrophenol			
104.	**Dinocap** (sum of dinocap isomers and their corresponding phenols expressed as dinocap) and Meptyldinocap**	**0.05***	**Dinocap- Out/Inclusion expired on 31/12/2009 Meptyldinocap- Decision Pending**
XVI) Aliphatic Nitrogen fungicides			
105.	**Cymoxanil****	**0.20**	**In**
XVII) Morpholine			

Sl. No.	Chemicals	Harmonized EU-MRL (mg/kg) updated on 11th October	Status in EU under Directive 91/414/EEC
106.	**Dimethomorph****	**3.00**	**In**
107.	Tridemorph	0.05*	Out
XVIII) Substituted Thiourea			
108.	Diafenthiuron	0.01	Out
109.	**Diuron** (Diuron including all components containing 3,4- dichloroaniline moiety expressed as 3,4-dichloroaniline)**	**0.05***	**In**
110.	Iodosulfuron-methyl (iodosulfuron-methyl including salts, expressed as iodosulfuron-methyl)	0.02*	In
111.	Isoproturon	0.05*	In/ Extension of the expiry date for inclusion (2010/77)
112.	Linuron	0.05*	In
113.	Lufenuron	1.00	In
114.	Pencycuron	0.05*	Out/ Application resubmitted for inclusion (Reg 33/2008)
XIX) Benzoylphenyl urea			
115.	Flufenoxuron	1.00	Out/ Application resubmitted for inclusion (Reg 33/2008)
XX) Strobilurin			
116.	**Azoxystrobin****	**2.00**	**In**
117.	Kresoxim methyl	1.00	In
118.	Pyraclostrobin	1.00	In
119.	Trifloxystrobin	5.00	In
XXI) Phenyl pyrazole			
120.	**Fipronil** (sum of fipronil + sulfone metabolite (MB46136) expressed as fipronil)**	**0.005***	**In/Additional provisions to protect honey bees introduced by Directive 2010/21/EU**
XXII) Pyrazole			
121.	**Fenpyroximate****	**0.30**	**In**
XXIII) Nitrophenyl ether			

Sl. No.	Chemicals	Harmonized EU-MRL (mg/kg) <u>updated on 11th</u> October	Status in EU under Directive 91/414/EEC
122.	Oxyfluorfen	0.10	Out/ Application resubmitted for inclusion (Reg 33/2008)
XXIV) Dinitroaniline			
123.	Pendimethalin	0.05*	In
124.	Trifluralin	0.10*	Out
XXV) Anilide/acetanilide and chloroacetanilide			
125.	Alachlor	0.05*	Out
126.	Butachlor	0.01	Out
127.	Carboxin	0.05*	Out/ Application resubmitted for inclusion (Reg 33/2008)
128.	Flufenacet (sum of all compounds containing the N fluorophenyl-N-isopropyl moiety expressed as flufenacet equivalent)	0.05*	In
129.	Metolachlor (with S-Metolachlor)	0.05*	Metolachlor-Out S-Metolachlor-In
130.	Novaluron	0.01*	Pending/Extension provisional authorization (2009/579)
XXVI) Miscellaneous group of chemicals			
131.	**<u>1-Naphthylacetic acid (alphanapthyl acetic acid)**</u>**	**0.05***	**Out**/ Application resubmitted for inclusion (Reg 33/2008)
132.	**<u>2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)**</u>**	**0.05***	**In/** Extension of the expiry date for inclusion (2010/77)
133.	6-Benzyl adenine	0.01	In/ Initially non included by decision 2008/941. Inclusion voted in November 2010 following resubmission for inclusion according to Reg. 33/2008
134.	Abamectin (sum of avermectin B1a, avermectinB1b and	0.01*	In

Sl. No.	**Chemicals**	**Harmonized EU-MRL (mg/kg) updated on 11th October**	**Status in EU under Directive 91/414/EEC**
	delta-8,9 isomer of avermectin B1a)		
135.	Azadirachtin	1.00	Out/ Application resubmitted for inclusion (Reg 33/2008)
136.	Bifenazate	0.01*	In
137.	**Buprofezin****	**1.00**	In/ Initially non included by decision 2008/771. Included as from 1 Feb. 2011 following resubmission for inclusion according to Reg. 33/2008
138.	Cartap hydrochloride	0.01	Out
139.	**Chlormequat (CCC)****	**0.05***	**In**
140.	Diflubenzuron	1.00	In
141.	**Homobrassinolide**	**0.01†**	**Not mentioned**
142.	Diquat	0.05*	In/ Extension of the expiry date for inclusion (2010/77)
143.	Dithianon	3.00	Out/ Application resubmitted for inclusion (Reg 33/2008)
144.	Dodine	0.20*	In/ Initially non included by decision 2008/934. Included as from 1 June 2011 following resubmission for inclusion according to Reg. 33/2008
145.	**Emamectin Benzoate****	**0.05**	**Decision Pending**
146.	Ethephon	0.70	In
147.	Fenazaquin	0.20	Out/ Application resubmitted for inclusion (Reg 33/2008)
148.	Flubendiamide	0.01*	Decision Pending
149.	**Forchlorfenuron (CPPU)****	**0.05***	**In**
150.	**Fosetyl-Al (sum fosetyl + phosphorous acid and their**	**100.00**	**In**

Sl. No.	**Chemicals**	**Harmonized EU-MRL (mg/kg) <u>updated on 11th</u> October**	**Status in EU under Directive 91/414/EEC**
	salts, expressed as fosetyl)		
151.	**Gibberellic acid****	**5.00**	**In**
152.	Hexythiazox	1.00	Out/ Application resubmitted for inclusion (Reg 33/2008)
153.	**Hydrogen cyanamide (Cyanamide including salts expressed as cyanamide)**	**0.05***	**Out/** Application resubmitted for inclusion (Reg 33/2008)
154.	Isoprothiolane	0.01	Out
155.	Mandipropamid	2.00	Pending/Extension provisional authorization (2009/579)
156.	Mepiquat	0.30	In
157.	Metribuzin	0.10*	In
158.	Milbemectin (sum of MA4+8,9Z-MA4, expressed as milbemectin)	0.05*	In
159.	Oxadiazon	0.05*	In
160.	**Paraquat****	**0.02***	**Out**
161.	Propargite	7.00	Out**/** Application resubmitted for inclusion (Reg 33/2008)
162.	Pyriproxyfen	0.05*	In
163.	**Spinosad (sum of Spinosyn A+D)****	**0.50**	**In**
164.	Spiromesifen	0.02*	Pending/Extension provisional authorization (2009/579)
165.	Trichlorfon	0.50	Out
166.	Tricyclazole	0.05*	Out
167.	**Uracil**	**1.00†**	**Not mentioned**
XXVII) Inorganic			
168.	Cadmium	0.05#	Heavy metal contaminant
169.	**Copper compounds (**all copper fungicides as elemental Cu; **Bordeaux Mixture, Copper oxychloride, Copper hydroxide**)**	**50.0**	**In**

Sl. No.	Chemicals	Harmonized EU-MRL (mg/kg) updated on 11th October	Status in EU under Directive 91/414/EEC
170.	Lead	0.20#	Heavy metal contaminant
171.	**Sulphur**	**0.00**	**Sulphur-In Lime sulphur-Out Listed in Annex 4 of EU‡**

* EU-MRL set at LOQ (mg/kg) as per http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=substance.selection

† These are natural products. EU-MRL does not exist for these chemicals. Hence, their MRL is set at the LOQ of the method developed and validated at the National Referral Laboratory of the NRC for Grapes.

** Pesticides registered for use in grapes for control of insect pests, diseases and weeds approved by the CIB of Ministry of Agriculture, Government of India, New Delhi under the Insecticides Act 1968

#Reference: Commission Regulation (EC) No 1881/2006 of 19th December 2006

‡ Annex IV: Active substances of plant protection products evaluated under Directive 91/414/EEC for which no MRLs are required because residues arising from use of the active substance are indistinguishable from natural background levels or other sources.

In = Chemicals authorized in EU

Out = Authorization of these chemicals in EU is withdrawn
Out/Banned = Chemicals are Banned in EU

Indian MRL Standards under the Food Safety Standards and Regulations

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
(1)	(2)	(3)	(4)
1	Aldrin, dieldrin (the limits apply to aldrin and dieldrin singly or in any combination and are expressed as dieldrin)	Foodgrains	0.01
		Milled Foodgrains	Nil
		Milk and Milk products	0.15 (on a fat basis)
		Fruits and Vegetables	0.1
		Meat	0.2
		Eggs	0.1 (on a shell free basis)
2	Carbaryl	Fish	0.2
		Food grains	1.5
		Milled food grains	Nil
		Okra and leafy vegetables	10.0
		Potatoes	0.2
		Other vegetables	5.0
		Cottonseed (whole)	1.0
		Maize cob (kernels)	1.0
		Rice	2.50
		Maize	0.50
		Chillies	5.00
3	Chlordane (residue to be measured as cis plus trans chlordane)	Food grains	0.02
		Milled food grains	Nil
		Milk and milk products	0.05 (on a fat basis)
		Vegetables	0.2
		Fruits	0.1
		Sugar beet	0.3
4	D.D.T. (The limits apply to DDT, DDD and DDE singly or in any combination	Milk and milk products	1.25 (on a fat basis)
		Fruits and vegetables including potato	3.5
		Meat, poultry and fish	7.0 (on a whole product basis
		Eggs	0.5 (on a shell free basis)
5.	D.D.T. (singly)	Carbonated Water	0.001
6.	D.D.D. (singly)	Carbonated Water	0.001
7.	D.D.E. (singly)	Carbonated Water	0.001

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
8	Diazinon	Foodgrains	0.05
		Milled foodgrains	Nil
		Vegetables	0.5
9.	Dichlorvos (content of di-chloroacetaldehyde (D.C.A.) be reported where possible)	Foodgrains	1.0
		Milled foodgrains	0.25
		Vegetables	0.15
		Fruits	0.1
10.	Dicofol	Fruits and Vegetables	5.0
		Tea (dry manufactured)	5.0
		Chillies	1.0
11.	Dimethoate (residue to be determined as dimethoate and expressed as dimethoate)	Fruits and Vegetables	2.0
		Chillies	0.5
12.	Endosulfan (residues are measured and reported as total of endosulfan A and B and endosulfan-sulphate)	Fruits and Vegetables	2.0
		Cottonseed	0.5
		Cottonseed oil (crude)	0.2
		Bengal gram	0.20
		Pigeon Pea	0.10
		Fish	0.20
		Chillies	1.0
		Cardamom	1.0
13	Endosulfan A	Carbonated Water	0.001
14	Endosulfan B	Carbonated Water	0.001
15	Endosulfan-Sulphate	Carbonated Water	0.001
16.	Fenitrothion	Foodgrains	0.02
		Milled foodgrains	0.005
		Milk and Milk Products	0.05 (on a fat basis)
		Fruits	0.5
		Vegetables	0.3
		Meat	0.03
17.	Heptachlor (combined residues of heptachlor and its epoxide to be determined and expressed as Heptachlor)	Foodgrains	0.01
		Milled foodgrains	0.002
		Milk and Milk Products	0.15(on a Fat basis)
		Vegetables	0.05
18.	Hydrogen cyanide	Foodgrains	37.5
		Milled foodgrains	3.0
		Foodgrains	Nil
19.	Hydrogen Phosphide	Milled foodgrains	Nil
		Foodgrains	25.0

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
20.	Inorganic bromide (determined and expressed as total bromide From all sources)	Milled Foodgrains	25.0
		Fruits	30.0
		Dried fruits	30.0
		Spices	400.00
21.	Hexachlorocycle hexane and its Isomers	Rice grain unpolished	0.10
	(a) Alfa (α) Isomer:	Rice grain polished	0.05
		Milk (whole)	0.05
		Fruits and vegetable	1.00
		Fish	0.25
		Carbonated Water	0.001
		Rice grain Unpolished	0.10
	(b) Beta (β) Isomer :	Rice grain polished	0.05
		Milk (whole)	0.02
		Fruits and vegetable	1.00
		Fish	0.25
		Carbonated Water	0.001
		Food grains except rice	0.10
	(c) Gamma (γ) Isomer (Known as Lindane)	Milled foodgrains	Nil
		Rice grain Unpolished	0.10
		Rice grain polished	0.05
		Milk	0.01 (on Whole basis)
		Milk products	0.20 (on fat basis)
		Milk products (having less than 2 per cent fat)	0.20 (on Whole basis)
		Fruits and vegetable	1.00
		Fish	0.25
		Eggs	0.10 (On shell free basis)
		Meat and poultry	2.00 (On Whole basis)
		Carbonated Water	0.001
		Rice grain Unpolished	0.10
	(d) Delta (δ) Isomer :	Rice grain Polished	0.05
		Milk (whole)	0.02

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
		Fruits & vegetables	1.00
		Fish	0.25
		Carbonated Water	0.001
		Foodgrains	4.0
22.	Malathion (Malathion to be determined and expressed as combined residues of malathion and malaoxon)	Milled foodgrains	1.0
		Fruits	4.0
		Vegetables	3.0
		Dried fruits	8.0
		Carbonated Water	0.001
		Fruits and Vegetables	0.5
23.	Parathion (Combined residues of parathion and paraoxon to be determined and expressed as parathion)	Fruits	0.2
24.	Parathion methyl (combined residues of parathion methyl and its oxygen analogue to be determined and expressed as parathion methyl)	Vegetables	1.0
		Foodgrains	0.05
25.	Phosphamidon residues (expressed as the sum of phosphamidon and its desethyl derivative)	Milled foodgrains	Nil
		Fruits and Vegetables	0.2
		Foodgrains	Nil
26.	Pyrethrins (sum of pyrethrins I & II and other structurally related insecticide Ingredients of pyrethrum)	Milled foodgrains	Nil
		Fruits and Vegetables	1.0
		Foodgrains	0.025
27.	CHLORIENVINPHOS	Milled Foodgrains	0.006
		Milk and Milk Products	0.02 (fat basis)
	(Residues to be measured as alpha and beta isomers of Chlorienvinphos	Meat and Poultry	0.2 (carcass fat)
		Vegetables	0.05
		Groundnuts	0.05 (shell free basis)
		Cotton seed	0.05
		Fruits	1.0
28.	CHLOROBENZILATE	Dry Fruits, Almonds And Walnuts	0.2 (shell free basis)
		Foodgrains	0.05
29.	CHLORPYRIFOS	Milled foodgrains	0.01
		Fruits	0.5
		Potatoes and Onions	0.01

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
		Cauli Flower and Cabbage	0.01
		Other vegetables	0.2
		Meat and Poultry	0.1 (carcass fat)
		Milk and Milk Products	0.01(fat basis)
		Cotton seed	0.05
		Cottonseed oil (crude)	0.025
		Carbonated Water	0.001
		Foodgrains	0.01
30	2,4D	Milled foodgrains	0.003
		Potatoes	0.2
		*Milk and Milk Products	0.05
		*Meat and Poultry	0.05
		Eggs	0.05 (shell free basis)
		Fruits	2.0
		Tea (dry manufactured)	5.0
31	ETHION (Residues to be determined as ethion and Its oxygen analogue and expressed as ethion)	Cucumber and Squash	0.5
		Other Vegetables	1.0
		Cotton seed	0.5
		*Milk and Milk Products	0.5(fat basis)
		*Meat and Poultry	0.2 (carcass Fat basis)
		Eggs	0.2 (shell free basis)
		Foodgrains	0.025
		Milled foodgrains	0.006
		Peaches	1.0
		Other fruits	2.0
		Dry fruits	0.1 (shell free basis)
		Citrus fruits	0.2
32.	FORMOTHION (Determined as dinethoate and its oxygen Analogue and expressed as dimethoate except in case of citrus fruits where it is to be determined as formothion)	Other fruits	1.0
		Vegetable	2.0
		Peppers and Tomatoes	1.0
		Foodgrains	0.025

Sl. No.	**Name of Insecticides**	**Food**	**Tolerance limit mg/kg.ppm)**
33.	MONOCROTOPHOS	Milled Foodgrains	0.006
		Citrus fruits	0.2
		Other fruits	1.0
		Carrot, Turnip, Potatoes	
		and Sugar beet	0.05
		Onion and Peas	0.1
		Other Vegetables	0.2
		Cottonseed	0.1
		Cottonseed oil (raw)	0.05
		*Meat and Poultry	0.02
		*Milk and Milk Products	0.02
		Eggs	0.02 (shell free basis)
		Coffee (Raw beans)	0.1
		Chillies	0.2
		Cardamom	0.5
		Foodgrains	0.1
34.	PARAQUAT Dichloride (Determined as Paraquat cations)	Milled foodgrains	0.025
		Potato	0.2
		Other vegetables	0.05
		Cotton seed	0.2
		Cottonseed oil (edible refined)	0.05
		*Milk (whole)	0.01
		Fruits	0.05
		Pears	2.0
35.	PHOSALONE	Citrus fruits	1.0
		Other fruits	5.0
		Potatoes	0.1
		Other vegetables	1.0
		Rapeseed/Mustard Oil (crude)	0.05
		Foodgrains	0.05
36.	TRICHLORFON	Milled foodgrains	0.0125
		Sugar beet	0.05
		Fruits and Vegetables	0.1
		Oil seeds	0.1
		Edible Oil (refined)	0.05
		*Meat and Poultry	0.1
		*Milk (whole)	0.05
		Foodgrains	0.025
37.	THIOMETON	Milled foodgrains	0.006

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
	(Residues determined as thiometon its sulfoxide and sulphone expressed as thiometon)	Fruits	0.5
		Potato, Carrots and Sugar beets	0.05
		Other vegetables	2.5
		Safflower seed	2.0
38.	Acephate	Cotton Seed	2.0
		Safflower seed	0.1
39.	Methamido-phos (A metabolite of Acephate)	Cotton seed	0.1
		Potato	0.5
40.	Aldicarb (sum of Aldicarb its sulphoxide and sulphone, expressed as Aldicarb)	Chewing Tobacco	0.1
		Maize	Nil
41.	Atrazine	Sugarcane	0.25
		Foodgrains	0.50
42.	Carbendazim	Milled foodgrains	0.12
		Vegetables	0.50
		Mango	2.00
		Banana (whole)	1.00
		Other fruits	5.00
		Cotton seed	0.10
		Groundnut	0.10
		Sugar beet	0.10
		Dry fruits	0.10
		Eggs	0.10 (shell free basis)
		Meat & Poultry	0.10 (Carcass fat basis)
		Milk & Milk Products	0.10 (fat basis)
		Foodgrains	0.50
43.	Benomyl	Milled foodgrains	0.12
		Vegetables	0.50
		Mango	2.00
		Banana (whole)	1.00
		Other fruits	5.00
		Cotton seed	0.10
		Groundnut	0.10
		Sugar beet	0.10
		Dry fruits	0.10
		Eggs	0.10 (shell free basis)
		Meat & Poultry	0.10 (carcass fat basis)

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
		Milk & Milk Products	0.10 (fat basis)
		Fruit & Vegetables	15.00
44.	Captan	Foodgrains	0.10
45.	Carbofuran (sum of carbofuran and 3-hydroxy carbofuran expressed as carbofuran)	Milled foodgrains	0.03
		Fruit & Vegetables	0.10
		Oil seeds	0.10
		Sugarcane	0.10
		Meat & Poultry	0.10 (carcass fat basis)
		Milk & Milk Products	0.05 (fat basis)
46.	Copper Oxychloride (determined as copper)	Fruit	20.00
		Potato	1.00
		Other vegetables	20.00
47.	Cypermethrin (sum of isomers) (fat soluble residue)	Wheat grains	0.05
		Milled wheat grains	0.01
		Brinjal	0.20
		Cabbage	2.00
		Bhindi	0.20
		Oil seeds except groundnut	0.20
		Meat and Poultry	0.20 (carcass fat basis
		Milk and Milk Products	0.01 (fat basis)
		Cotton Seed	0.10
48.	Decamethrin / Deltamethrin	Food grains	0.50
		Milled Foodgrains	0.20
		Rice	0.05
49.	Edifenphos	Rice	0.02
		Rice bran	1.00
		Eggs	0.01 (shell free basis)
		Meat and poultry	0.02 (carcass fat basis)
		Milk and Milk products	0.01 fat basis)
50.	Fenthion (sum of fenthion, its oxygen analogue and their sulphoxides and sulphones expressed as fenthion)	Food grains	0.10
		Milled food grains	0.03
		Onion	0.10
		Potatoes	0.05
		Beans	0.10
		Peas	0.50
		Tomatoes	0.50

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
		Other vegetables	1.00
		Musk melon	2.00
		Meat and Poultry	2.00 (carcasss fat basis)
		Milk and Milk products	0.05 (fat basis)
		Cauliflower	2.00
51.	Fenvalerate (fat soluble residue)	Brinjal	2.00
		Okra	2.00
		Cotton Seed	0.20
		Cotton seed oil	0.10
		Meat and Poultry	1.00 (carcass fat basis)
		Milk and Milk Product	0.01 (fat basis)
		Food Grains	0.20
52.	Dithiocarbamates (the residue tolerance limit are determined and expressed as mg/CS2/kg and refer separately to the residues arising from any or each group of dithiocarbamates	Milled food grains	0.05
	(a) Dimethyl dithiocarbamates residue resulting from the use of ferbam or ziram, and	Potatoes	0.10
		Tomatoes	3.00
		Cherries	1.00
	(b) Ethylene bis- dithiocarbamates resulting from the use of mancozeb, maneb or zineb (including zineb derived from nabam plus zinc sulphate)	Other fruits	3.00
		Chillies	1.0
	(c) Mancozeb	Foodgrains	0.05
53.	Phenthoate	Milled foodgrains	0.01
		Oilseeds	0.03
		Edible oils	0.01
		Eggs	0.05 (shell free basis)
		Meat & Poultry	0.05 (carcass fat basis)
		Milk & Milk products	0.01 (fat basis)
		Foodgrains	0.05
54.	Phorate (sum of Phorate, its oxygen analogue and their sulphoxides and sulphones,	Milled foodgrains	0.01
		Tomatoes	0.10
		Other vegetables	0.05
		Fruits	0.05

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
	expressed as phorate)	Oil seeds	0.05
		Edible oils	0.03
		Sugarcane	0.05
		Eggs	0.05 (shell free basis)
		Meat & Poultry	0.05 (carcass fat basis)
		Milk & Milk Products	0.05 (fat basis)
		Maize	Nil
55.	Simazine	Sugarcane	0.25
		Rice	0.50
56.	Pirimiphos-methyl	Food grains except rice	5.00
		Milled food grains except rice	1.00
		Eggs	0.05 (shell free basis)
		Meat & Poultry	0.05 (carcass fat basis)
		Milk & Milk Products	0.05 (fat basis)
		Cotton Seed	0.05
57.	Alachlor	Groundnut	0.05
		Maize	0.10
		Soyabeans	0.10
		Pine-Apple	0.50
58.	Alfa Nephthyl Acetic Acid (A.N.A.)	Wheat	0.05
59.	Bitertanol	Groundnut	0.10
		Tomato	5.00
60.	Captafol	Rice	0.50
61.	Cartaphydrochloride	Grape	1.00
62.	Chlormequatchloride	Cotton Seed	1.00
		Groundnut	0.10
63.	Chlorothalonil	Potato	0.10
		Cotton Seed	0.20
64.	Diflubenzuron	Apple	5.00
65.	Dodine	Cotton Seed	1.00
66.	Diuron	Banana	0.10
		Maize	0.50
		Citrus	1.00
		(Sweet Orange)	
		Grapes	1.00
		Pine Apple	2.00

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
67.	Ethephon	Coffee	0.10
		Tomato	2.00
		Mango	2.00
		Cotton Seed	0.05
68.	Fluchloralin	Soya Beans	0.05
		Onion	15.00
69.	Malic Hydrazide	Potato	50.00
		Bajra	0.05
70.	Metalyxyl	Maize	0.05
		Sorghum	0.05
		Cotton Seed	0.10
71.	Methomyl	Rice	0.05
72.	Methyl Chloro-phenoxy-acetic Acid (M.C.P.A.)	Wheat	0.05
		Rice	0.03
73.	Oxadiazon	Food-grains	0.02
74.	Oxydemeton methyl	Cucumber	0.50
75.	Permethrin	Cotton Seed	0.50
		Soya Beans	0.05
		Sunflower Seed	1.00
		Rice	0.01
76.	Quinolphos	Pigeon pea	0.01
		Cardamom	0.01
		Tea	0.01
		Fish	0.01
		Chillies	0.2
		Apple	5.00
77.	Thiophenatemethyl	Papaya	7.00
		Chillies	0.2
78	Triazophos	Rice	0.05
		Cotton seed oil	0.1
		Soyabean oil	0.05
		Cotton seed oil	0.05
79	Profenofos	Cotton seed oil	0.05
80	Fenpropathrin	Apple	5.0
81	Fenarimol	Apple	0.1
82	Hexaconazole	Rape seed	0.5
83	Iprodione	Mustard seed	0.5
		Rice	10.0
		Tomato	5.0
		Grapes	10.0
		Wheat	0.1
84.	Tridemorph	Grapes	0.5
		Mango	0.05
		Grapes	0.2
85.	Penconazole	Wheat	0.05

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
86	Propiconazole	Groundnut seed	0.1
87	Myclobutanil	Grapes	1.0
		Wheat	0.02
88	Sulfosulfuron	Wheat	0.05
89	Trifluralin	Rice	0.01
90	Ethoxysulfuron	Soyabean Oil	0.05
91	Metolachlor	Tea	1.0
92	Glyphosphate	Pea	0.05
93	Linuron	Rice	0.05
94	Oxyfluorfen	Groundnut Oil	0.05
		Rice	0.2
95	Carbosulfan	Rice	0.02
96	Tricyclazole	Cotton seed Oil	0.05
97	Imidacloprid	Rice	0.05
		Rice	0.05
98	Butachlor	Wheat	0.05
99	Chlorimuron-ethyl	Wheat	0.1
100	Diclofop-methyl	Soyabean Oil	0.1
101	Metribuzin	Cotton seed Oil	0.05
102	Lambdacyhalothrin	Tea	3.0
103	Fenazaquin	Wheat	0.05
104	Pendimethalin	Rice	0.05
		Soyabean Oil	0.05
		Cotton seed Oil	0.05
105	Pretilachlor	Rice	0.05
		Cotton seed Oil	0.05
106	Fluvalinate	Wheat	0.1
107	Metasulfuron-methyl	Wheat	0.5
108	Methabenzthiazuron	Soyabean oil	0.1
109	Imazethapyr	Groundnut oil	0.1
		Rice	0.5
110	Cyhalofop-butyl	Wheat	0.05
111	Triallate	Cotton seed oil	0.02
112	Spinosad	Cabbage	0.02
		Cauliflower	0.02
		Rice	0.02
113	Thiamethoxam	Rice	0.01
114	Fenobucarb	Cotton seed oil	0.02
115	Thiodicarb	Rice	0.1
116	Anilophos	Wheat	0.02
117	Fenoxy-prop-p-ethyl	Soyabean seed	0.02
		Tea	0.01
118	Glufosinate-ammonium	Wheat	0.1
119	Clodinafop-propanyl	Apple	0.1
120	Dithianon	Rice	0.2

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
121	Kitazin	Rice	0.1
122	Isoprothiolane	Cotton seed oil	0.1
123	Acetamiprid	Grapes	0.1
124	Cymoxanil	Wheat	0.5
125	Triadimefon	Pea	0.1
		Grapes	2.0
		Grapes	10
126	Fosetyl-A1	Cardamom	0.2
		Wheat	0.1
127	Isoproturon	Tea	10.0
128	Propargite	Apple	0.01
129	Difenoconazole	Cotton seed	0.02
130	b-Cyfluthrin	Rice	0.01
131	Ethofenprox	Cotton seed	0.05
132	Bifenthrin	Red Gram	0.05
133	Benfuracarb	Rice	0.05
		Soyabean seed	0.05
134	Quizalofop-ethyl	Rice	0.05
135	Flufenacet	Rice	0.05
136	Buprofezin	Grapes	0.05
137	Dimethomorph	Potatoes	0.05
		Cabbage	0.05
138	Chlorfenopyr	Cotton seed	0.1
139	Indoxacarb	Cottonseed oil	0.1
		Cabbage	0.1
		Tomato	5.0
140	Metiram	Ground nut seed	0.1
		Ground nut seed oil	0.1
		Cabbage	0.3
141	Lufenuron	Rice	1.0
142	Carpropamid	Cottonseed	0.01
143	Novaluron	Cottonseed oil	0.01
		Tomato	0.01
		Cabbage	0.01
		Rice	0.1
144	Oxadiargyl	Rice	0.01
145	Pyrazosulfuron ethyl	Rice	0.01
146	Clomazone	Soyabean seed	0.01
		Soyabean seed oil	0.01
		Wheat	0.05
147	Tebuconazole	Apple	1.0
148	Propineb	Pomegranate	0.5
		Potato	0.5
		Green Chillies	2.0
		Grapes	0.5

Sl. No.	Name of Insecticides	Food	Tolerance limit mg/kg.ppm)
		Cotton seed	0.05
149	Thiochlorprid	Cotton seed oil	0.05
		Rice	0.01

*: Soluble in water, hence not necessary to mention on fat basis.

EXPLANATION :- For the purpose of this regulation :

(a) the expression “insecticide” shall have the meaning assigned to it in the Insecticide Act, 1968 (46 of 1968);

(b) unless otherwise stated :

(i) maximum levels are expressed in mg./kg. on a whole product basis.

(ii) all foods refer to raw agricultural products moving in commerce.

DEPARTMENT OF AGRICULTURAL MARKETING

CO-OPERATION AND BUSINESS MANAGEMENT

Schedule

Name of Farmer:

Age:

Education:

District: Taluk: Village:

1. Area Under Cultivation:
2. Age of Vines:
3. Grape Variety:
4. Average Yield:
5. Major Attacks in the past 5 years:
6. Pest/Disease Timperiod
7. Chemicals used regularly in farming:

   Chemical Dosage Frequency Timing

8. Chemicals used specifically during pest attacks

Chemical	Dosage	Frequency	Timing

9. Technological Gap in pesticide usage :

   Recommended Chemical (Y/N):

   Recommended Dosage(Y/N):

   Recommended Frequency(Y/N):

   Recommended Timing (Y/N):

   Correct Handling/Disposal Practices (Y/N):

   Proper Safety Equipment (Y/N):

   IPM measures (Y/N):

   Post Harvest Treatment Measures (Y/N):

10. Reason for divergence from recommended practices:

    Lack of Knowledge/Training

    Non availability of chemicals/equipment

    Cost Considerations

    Conflicting Advice from peers/dealers

Fear of Economic Damage to the Crop

Absence of incentive

11. Factors Influencing Pesticide Usage Pattern

Economic Considerations (Low/Medium/High)

Dealer/Peer Recommendation (Low/Medium/High)

Intensity of Outbreak (Low/Medium/High)

Mode of Produce Disposal (Low/Medium/High)

Information of Pest/Disease
Outbreaks in past 5 years (Low/Medium/High)

Knowledge level of Farmer (Low/Medium/High)

Credit Availability (Low/Medium/High)

12. Degree of awareness about export markets

MRL Standards (Y/N):

GAP Certification Information (Y/N):

Grade Specifications (Y/N):

Export Procedure

Documentation and Certification (Y/N):

Traceability Norms (Y/N):

Payment terms and

Contract Terminology (Y/N):

Residue Testing

and Sampling Practices(Y/N):

APEDA and

DGFT Registration (Y/N):

Phyto-sanitary Certification (Y/N):

Excise and Customs Procedure (Y/N):