



Vision 2030



National Research Centre for Grapes

(Indian Council of Agricultural Research)

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Contents

Foreword	i
Preface	iii
Preamble	v
Viticulture Scenario	1
National Research Centre for Grapes	3
NRC Grapes 2030	5
Harnessing Science	7
Strategy and Framework	10
Epilogue	12
References	12
Annexure 1: Strategic framework	13

Foreword

The diverse challenges and constraints as growing population, increasing food, feed and fodder needs, natural resource degradation, climate change, new parasites, slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutions of ICAR to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, all of the institutions of ICAR, have revised and prepared respective Vision-2030 documents highlighting the issues and strategies relevant for the next twenty years.

The National Research Centre for Grapes (NRCG), Pune is an apex institution in the country spearheading viticultural and enology research for productivity enhancement and diversification of Indian viticulture into value added products like raisins, wine besides juice. The comprehensive initiatives taken by the Council through NRCG have led to notable accomplishments in crop improvement, production technologies to overcome several production constraints and value addition through technological interventions. Developing high yielding and good quality table and industrial use varieties with basal resistance to the biotic and abiotic stresses, and technology generation for greater input use efficiency, integrated pest management, post-harvest handling, processing, packaging including value-addition are the major research programmes at this Centre.

It is expected that the analytical approach and forward

looking concepts presented in the ‘Vision 2030’ document will prove useful for the researchers, policymaker, and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.



(S. AYYAPPAN)

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Dated the 29th June, 2011

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Preface

The country is in the midst of a horticulture revolution. Grape is emerging as an important fruit crop of India; it has the third highest productivity and is the highest among fruit crops in earning foreign exchange. Further, it is receiving importance in creating jobs on the farm and other related sectors. With this background a National Research Center was started in the VIII Plan especially to cater to research needs of the grape industry of India. At present out of total estimated area of 5.34 million ha under fruit crops in India, grape occupies 106 thousand hectares mainly producing table grapes. However, with the recent trend of wine making, the sector is growing at a very high rate of 25-30 per cent per year and therefore, the research programmes in this sector will be focused more in the coming years.

The grape growers of India are a highly dedicated and committed group, and are ready to make a mark in the world grape trade. It is mainly through their efforts that grape cultivation has slowly emerged from the unorganized to an organized sector. Not only the elite group of growers-exporters but a large number of smaller growers, too, have become aware of the Good Agricultural Practices (GAP), and are even complying with the Europe GAP standards.

In the first decade of its existence, the Centre had made concerted efforts to develop strong linkages with the growers and their associations to understand the problems faced by them. Many issues related to grape production were resolved based on existing knowledge, surveys and laboratory and field studies. The Centre gave due importance to Transfer of

Technology (TOT) and this investment in TOT has enhanced its credibility among peer groups and stakeholders.

It is hoped that this document 'VISION 2030' will serve as a background paper for the officials of the GOI, MOA, DARE, ICAR to plan for the critical inputs to this Centre, especially in terms of manpower, finance, international collaboration and human resource development to enable it to meet the future challenges posed by the grape industry of India. Help received from Dr. Anuradha Upadhyay, Dr. Indu Sawant and other colleagues of the Institute in preparation of this document is highly appreciated.



Dated 30th June 2011
Pune

(P. G. ADSULE)
Director

Preamble

National Research Centre for Grapes, Pune was established in January 1997 to undertake mission-oriented research to address the issues related to grape production and processing in India. During last thirteen years, the institute has made tremendous progress in terms of infrastructure development, research output and technology dissemination. With a few rented rooms in the office of the Maharashtra Rajya Draksh Bagaitdar Sangh (MRDBS) in Manjri in the beginning, the institute now has a laboratory cum administrative building, separate buildings of biocontrol laboratory, National Referral Laboratory, farm office, raisin shed, three poly/FRP houses and experimental vineyards spread over 17 ha. The institute has now world-class research infrastructure in terms of high tech instruments and tools. LC-MS/MS, GC-MS/MS-TOF, ICP-MS, genetic analyzer, real time PCR machine, IRGA, canopy analyzer, wine analyzer, AAS, multichannel autoanalyzer, programmable ELISA plate reader, plant growth chamber and incubators, stereo microscopes of high magnification, different types of centrifuges are some of the high-tech equipments available for conducting basic and strategic research.

The institute is the site for National Grape Gene Bank and has almost 425 grape accessions in its field germplasm collection. Such an excellent infrastructure has resulted in recognition of the Centre for postgraduate studies by Pune University, Pune and Shivaji University, Kolhapur besides other universities in the country and every year several students complete their six months project work at this Institute. A nursery with a three star rating from NHB

provides true to type and genuine and disease-free planting material of promising rootstock and commercial table and wine grape varieties. Transfer of technology through regular field visits of scientists of the Institute and their participation in growers' seminars, in house interaction, training programmes and information placed on website has increased the Institute's clear visibility and credibility among the growers and other stakeholders of grape industry. Successful implementation of APEDA funded Pesticide Residue Monitoring Plan for export grape has contributed substantially to the stature of the Institute.



Viticulture Scenario

Viticulture in India started in early 1960 and today assumes an important position in horticulture crop in view of its area occupied, production, value addition and job creation in both rural and urban areas. Today grape has occupied an area of 106 thousand ha with a total production of 974 thousand tonnes. However, the highest production of 1.88 million tonnes has been reported from an area of 80 thousand ha during 2008-09. Majority of the area is occupied by table grapes and leaving a small portion in the range of 3000 to 5000 ha under wine grapes. Major area in the country is spread in the States of Maharashtra (to the extent of 70 to 80 per cent in Nasik, Solapur, Sangli, Satara, Pune and Latur districts) followed by Karnataka (Bijapur, Bangalore, Belgum, Gulbarga, Raichur districts), Andhra Pradesh (Hyderabad and Ranga Reddy districts) and Tamil Nadu (Theni, Coimbatore, Madurai districts) and small parts in North Indian States (Punjab, Uttar Pradesh, Haryana, Himachal Pradesh, Jammu & Kashmir) and East Indian States. Area is now further increasing in Karnataka and Tamil Nadu in view of their policy measures for the promotion of wine grape cultivation for wine purpose.

Among all the horticultural crops, this fruit has received a special importance in view of its value addition into raisin almost 18 to 20 per cent, wine 1 to 2 per cent, juice 0.5 per cent and export 3.5 per cent to European Union, Gulf countries and Bangladesh. Raisin and wine production has reached to 1 lakh tonnes and 13.2 million litres respectively.

In view of increasing production of raisins and wine for local consumption and also for export, grape cultivation is receiving a lot of attention for its improved varieties and accessions, vineyard establishment, propagation and nursery techniques, training and pruning system, inputs such as irrigation, fertilizers and use of various agrochemicals to improve the quality of table and wine grapes and management of various disease

and insect pests. Globally grape cultivation is concentrated in temperate and subtropical regions and mainly used for wine production, while our grape cultivation is confined to tropical and peninsular belt and mainly used for fresh purpose i.e. table purpose and now started diversification to raisin, wine and juice. Being in tropical region, the incidence of insect pests and disease is more and the plant is ever-growing without any rest period (dormancy) which is contrary in temperate cultivation. As a result of these factors, our requirements of inputs and its cost apart from labour requirements are more as compared to temperate cultivation. Further, the climate change in terms of untimely precipitation in annual cycle of crop and stress of heat and other climatic factors also influences the productivity and quality of crop. Considering these factors in the tropical grape cultivation, our research priorities are different and concentrated to overcome these problems with optimum and quality grape production at globally competitive price for both table purpose and other processed products such as raisin and wine.

In view of contribution of viticulture to national economy, efforts towards small holders viticulture, deteriorating production environment, climate change and viticulture, emergence of agribusiness and more sustainable grape production with quality at globally competitive cost of production, developments of technologies in molecular biology, biotechnology, nanotechnology, information technology and geo-spatial technology would certainly provide significant new opportunities for productivity enhancement with the solution to various problems and challenges being faced by the various stakeholders of viticulture industry.



National Research Centre for Grapes

National Research Centre for Grapes, Pune was established in January 1997 to undertake mission-oriented research to address the issues related to grape production and processing in India. During last thirteen years, the institute has made tremendous progress in terms of infrastructure development, research output and technology dissemination. The institute has world-class research infrastructure in terms of high tech instruments and tools for conducting basic and strategic research. The institute is the site for National Grape Gene Bank and has almost 425 grape accessions in its field germplasm collection. A nursery with a three star rating from NHB provides pure and genuine planting material of promising rootstock and commercial table and wine grape varieties. Transfer of technology through regular field visits, growers' seminars, in-house interaction with grape growers, training programmes and information placed on website has increased the Institute's clear visibility and credibility among the growers and other stakeholders of grape industry. Successful implementation of APEDA funded Pesticide Residue Monitoring Plan for export grape has contributed substantially to the stature of the Institute

Mandate

To undertake the programmes covering basic and strategic research for resolving the major biotic and abiotic constraints affecting the grapes quality production, productivity, to sustain the productivity, promote diversification towards wine and other value added products and evaluation of technologies for developing region specific technologies.

Since its inception in 1997, the Centre has developed several technologies for grape industry. These include a variety 'Manjri Naveen' suitable for export, irrigation and fertilizer schedule for precision farming, rootstocks for sustained production under adverse condition, canopy management and judicious use of bioregulators for quality improvement,

weather based disease forecasting and advisory for disease management, bioefficacy and dissipation of several new molecules for their inclusion in IPM, assessment of quality standards for Indian raisins and wine.

The Centre has developed linkages and partnership with grape industry stake holders like state grape growers association, wine industry, state horticulture department, National Horticulture Board, Agricultural and Processed Food Products Export Development Authority, Indian Grape Processing Board, etc. It has partnership with several national agencies like Department of Biotechnology, Bhabha Atomic Research Centre, University of Pune, Shivaji University, Kolhapur apart from other universities and private sectors involved in agri-business.



NRC Grapes 2030

Vision

Harnessing viticulture and enology Science to ensure comprehensive and sustained grape production through crop improvement, assessment, refinement and adoption of most appropriate and precise technologies in grape production and value addition thereby increasing net returns to grape growers and all the stakeholders involved in the industry.

Mission

To undertake the programmes involving basic and strategic research for resolving the major biotic and abiotic constraints affecting the grape production, productivity and its quality and to have sustained productivity and promote diversification to wine production and other value added products

Focus

- i. Genetic resource enhancement, its evaluation and valuation for effective use to meet the challenges of biotic and abiotic stresses besides yield, quality and nutritional value.
- ii. Development of cultivars / production technology which can fit into achieving vertical growth and can sustain the impact of climate change, biotic and abiotic stresses and also to meet the consumers' requirement.
- iii. Utilize the tools of bio-informatics for collation, retrieval analysis and use of biological information and decision making process and to achieve maximum output.
- iv. Developing efficient system for management of nutrient and water to get maximum utilisation of these resources.

- v. Developing a model for plant architectural engineering and its management to harness maximum solar energy and other inputs.
- vi. Develop effective integrated management strategies for the biotic stresses to reduce the production losses including forecasting models, biocontrol system, and development of diagnostic techniques.
- vii. Develop a system for protecting cultivation to have maximum output from reduce land through development of cultivars and technologies suitable for protected cultivation.
- viii. Develop post-harvest technologies for value enhancement, reduction of losses and increased marketability.
- ix. Generation of eco-region specific technologies.
- x. Use of biotechnology, bioremediation, biosecurity, bioprospection and nanotechnology etc. for sustained grape production.
- xi. Mechanization for improved input use efficiency.
- xii. Inter-institutional networking for achieving the above goals.



Harnessing Science

The National Research Centre for Grapes would strive to harness power of science in increasing productivity, enhancing input-use efficiency, reducing cost and post-harvest losses, minimizing risks and improving quality of grape through conventional techniques as well as new science and tools. It would also attempt to realize diverse interests of different stakeholders in the food-supply chains.

In the present context, technological challenges are becoming more complex than before as demand for food is increasing and supply sources are dwindling. Incidentally, the science is also changing rapidly with the emergence of new tools, methods, techniques and approaches that promise technological breakthroughs to accomplish the mission.

Potential of genetic-resource enhancement

Much of the gains in the productivity of the food commodities in the past have been attributed to the genetic alterations of the crops and animals. This will continue to be the primary driver for augmenting productivity in the lesser time, space and cost. The NRC Grapes is the National active repository for grapes and has about 425 grape accessions. To address future needs of grape industry in India, the research will focus on characterization, genetic enhancement through clonal selection breeding for commercially important traits, development of tools for molecular breeding, functional genomics, proteomics, gene mining, molecular breeding through tools like marker-aided selection and gene stacking.

Biotechnology

Biotechnology has a considerable potential to address many of the challenges in the grape. Biotechnology tools like MAS will be developed

to speed up the grape breeding for important traits. Transcriptome and Proteome analysis would be taken up to elucidate the gene functioning.

Management of natural resources to improve production efficiency

More than 80 % of the grape cultivation is confined to the agro ecological zone 6 (hot semi-arid eco-region). Moisture stress and salinity are the key problems faced by the farming community for sustaining grape productivity. Ground water is the major contributing factor to salinity. The nutrient and water use efficiency is very poor because of poor physico-chemical properties of the soil, uncertainty in water availability and poor quality irrigation water.

The Soil organic pool is central to improving the fertility status of soil. Thus integrated nutrient management incorporating the judicious combination of organics, biofertilizers and inorganics and nutrient use based on stock-scion (Variety) combination to mitigate different abiotic stresses is needed. Seasonal changes in climatic conditions are impacting grape productivity through observable changes in terms of phenological events, such as budburst, flowering, veraison, harvest and finally yield. Thus, Nutrient and Irrigation schedule needs to be perfected/ standardised under such situations.

The performance of the vines deteriorate when raised on own roots and hence, rootstocks like Dog Ridge, 110R and others have become central to the successful table and wine grape cultivation respectively in the country. But, there is a continuous need for evaluating newer rootstocks for their salinity and drought tolerance in the field to cope up with ever increasing problems of drought and salinity.

Bio-risk management

Bio-risk is increasing with climate change and owing to trans-boundary insect-pests and diseases. It is adding cost, reducing food production and is adversely affecting farm income. To overcome problem of bio-risk, efforts would be made to develop effective and integrated risk-and-disaster management production systems and institutional mechanisms, which would bear risk. Bio-risk intelligent system (such as early warning systems, drought indicators, migratory movement of bio-risk agents, etc.) would be developed for taking informed decision at the local, regional and national level.

Diversification

Diversification for value addition and to prevent market glut has great potential. Research focus would be to develop technologies for improved and cost competitive raisins, wine and juice, enhancing shelf life for table grape and improving commercial traits like size and colour through pre and post-harvest approaches. Attempts will also be made to explore and promote alternate uses of grape like medicinal / antioxidants, distillery, pigment, etc.

Technology transfer systems

It is important to continuously strive to develop new and better technologies. Their effective delivery mechanism would greatly help in bringing wide gap between the potential and the realized productivity. More far-reaching, participatory information and communication technology would be evolved by optimizing print and delivery systems and by showcasing research products for effectively linking research accomplishments with the stakeholders.

Human resource development

Enhancing quality of human resource is a pre-requisite for implementing and upgrading research programmes, developing technologies, evolving institutional arrangements to face challenges and harness opportunities. Maintaining global standards and enhancing competitiveness are equally important in agri-business and in technology development. Efforts will be made to develop state-of-the art infrastructure and to enhance competence.



Strategy and Framework

A 4-point following strategy would be adopted to accomplish the vision and the goals of the NRC for Grapes (see Annexure 1).

- Improve efficiency of human and financial resources and effective utilization of infrastructure.
 - Formulate multidisciplinary eco-region-wise research and technology development programmes with national and international agencies;
 - Prioritize demand-driven research programme with focus on emerging market opportunities and stakeholders' requirements including requirements of grape industry;
 - Support grape cultivation in non-traditional areas by providing research and technology inputs.
 - Harness synergies of partners and stakeholders in developing improved technologies, systems and information for viticulture and enology.
- Facilitate accelerated dissemination of improved technologies, knowledge and information.
 - Develop and evolve models to link research and development activities with farmers and other stakeholders through information and communication technology and e-extension;
 - Provide state-of-the art scientific facilities in laboratories and infrastructure;
 - Address food safety concerns of the society.

- Enhance quality of human resource in agri-supply chain.
 - Provide training in latest technical innovations to stakeholders in grape production and marketing chain.
 - Provide training to scientists in niche areas.
 - Develop an accountable, professional, motivated and intellectual property rights-compatible, work culture; and
 - Facilitate in strengthening and streamlining higher viticulture and enology research system to meet future challenges.
- Commercialization of technologies through organized intellectual property rights and benefit-sharing system.
 - Facilitate and ensure IPR wherever applicable.



Epilogue

The National Research Centre for Grapes is continued to bring a demand driven technologies in order to sustain the grape productivity per unit area with better quality at competitive cost of production technology. The viticulture and enology research would certainly augment farmers' income, generate employment opportunities, promote exports and restrict inputs and increase value addition for higher and inclusive growth of this sector. Efforts would also be made to sensitize and facilitate in creating favourable institutional support to all stakeholders of grape industry.

Concentrated efforts would be made to be more sensitive to the immediate needs of grape growers. It would also develop mechanisms to regularly monitor various changes occurring at national and international level to develop appropriate research and other strategies to respond to the changes for the benefit of the stakeholders. All this would be attempted in a participatory mode by becoming more vigilant and introducing institutional processes which will develop a culture of responsibility, accountability and integrity of science.



References

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Annexure 1 : Strategic framework

Goal	Approach	Performance measure
Widen the genetic base to maintain sustained grape production under changing global scenario and also the climate change	<p>Collection, characterization, documentation and conservation of grape germplasm.</p> <p>Screening and evaluation of grape germplasm for biotic and abiotic stresses, suitability for different purposes, quality and yield parameters.</p> <p>Breeding for improved yield and quality in table and wine grape.</p> <p>Use of biotechnological tools to understand and tackle different issues.</p>	<p>Varieties/ hybrids developed/ released for different purposes</p> <p>Desired levels of yield, quality and tolerance to biotic/ abiotic stresses.</p> <p>Marker associated with QTLs</p>
Improve risk management	<p>Address climate risk in viticulture</p> <p>Approaches for climate change adaptation and mitigation</p> <p>Address market risk</p> <p>Support to farmer friendly insurance products to address climate change</p>	<p>Minimization of risk due to climate</p> <p>Early warning systems, weather based forecasting systems</p>
Enhance competitiveness of Indian grape and processed products	<p>Develop technologies to reduce cost of production of grape</p> <p>Develop horticultural practices for improving quality of grape and processed products</p> <p>Improve input use efficiency</p>	<p>Number of technologies developed and transferred</p> <p>Improved cost: benefit ratio</p>
Maintain and improve the status and quality of natural resources	<p>Management options to improve soil quality</p> <p>Technological options to enhance water use efficiency</p> <p>Management strategies for saline and alkaline soils</p>	<p>Number of technologies developed and transferred</p>
Improve production of grapes as per food safety standards	<p>Develop technologies for safe use of agrochemicals and other inputs</p> <p>Develop technology to minimize reliance on agrochemicals</p> <p>Develop strategies to monitor the food contaminant to enhance food safety and compliance to food laws.</p>	<p>No. of technologies developed</p> <p>Less or no rejection of produce in the market and compliance to food laws</p>

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Improve production of grapes as per food safety standards	<p>Develop technologies for safe use of agrochemicals and other inputs</p> <p>Develop technology to minimize reliance on agrochemicals</p> <p>Develop strategies to monitor the food contaminant to enhance food safety and compliance to food laws.</p>	<p>No. of technologies developed</p> <p>Less or no rejection of produce in the market and compliance to food laws</p>
Improve value addition and processing of grape	<p>Develop approaches to improve shelf life of grape.</p> <p>Development of pre and post harvest technologies for improving quality of grape processed product like raisins and wine.</p> <p>Develop technologies for demand driven value added products.</p> <p>Commercialization of processing technologies</p>	<p>Number of technologies developed</p> <p>Improved packages / storage to minimise the losses</p> <p>Processed produce meeting the international standards (Codex)</p> <p>Improved price realisation to the growers</p>
Strengthening linkages with grape sector	<p>Formalize the linkages with different stakeholders</p> <p>Undertake participatory research, development and extension</p>	No. of programmes/ linkages executed