वार्षिक प्रतिवेदन | Annual Report 2008-09

राष्ट्रीय अंगूर अनुसंधान केन्द्र
(भारतीय कृषि अनुसंधान परिषद)

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Correct Citation :
Annual Report 2008-09
National Research Centre for Grapes
Manjri Farm P.O., Solapur Road
Pune - 412 307, India

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Cover Page :
Manjri Naveen, a clonal selection of Centennial Seedless

Published by :
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Printed at : Flamingo Business Systems, Pune. Telefax : 020-24214636

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Preface

There is a continuous and steady growth of viticulture industry in India although there is some set back to wine industry due to slowdown in global economy. There are attempts to improve quality of raisins in terms of size, colour, grade and packing by introducing technology and machinery from leading country in raisin production like Turkey. There is strong awareness and increased demand among existing and prospective grape growers for quality plant materials of various grape rootstocks and grafted plants of both table and wine grape varieties from our mother nursery units and other public and private nurseries. In order to have quality, optimum and sustained crop production at most competitive price, growers are beginning to understand the importance of most appropriate and precise technology in term of use of fertilizers, chemicals, irrigation and crop protection agents apart from improved farm machinery. Keeping all this in view, the infrastructure was further strengthened and developed both in laboratories and on the experimental vineyards farm. The facilities developed during this period include laboratory equipments viz. Real Time PCR, Nanospectrophotometer, 80°C deep freezer and raisin shed etc.

The Institute is continuously progressing by leaps and bounds by introducing and commissioning most modern equipments to do research more efficiently and precisely in viticulture and enology. Organizations like Agricultural and Processed Food Products Export Development Authority (APEDA), Department of Biotechnology (DBT) and Bhabha Atomic Research Centre (BARC) continued their support to their ongoing research projects in the areas of food safety and quality of fresh and processed grape products, basic research in biotechnology leading to improved plant material and understanding mechanism of abiotic stress. Institute is working on development of new grape hybrids for both table and wine purpose apart from development of new clonal selections with better economic traits from introduced grape varieties in germplasm block and also from farmers vineyards. New chemical molecules and biological agents were also identified for managing diseases and pests, improving quality attributes of fruits in terms of berry size, colour, shelf life, bunch size and better canopy management. Monitoring food safety and quality in terms of their pesticide and contaminants residues in fresh and processed grape products is an important research and development programme in the National Referral Laboratory in close cooperation and support of APEDA under the Ministry of Commerce considering the requirement of quality parameters in table grapes for export to various countries. Our compliance in pesticide residues in table grapes for export to EU countries has improved over the period since 2003-2004 and presently the failure has been brought to the level of 3.5%. Salient work achievements during the period are elaborated in executive summary chapter of the report.

During this period, technical work of grape crop in All India Coordinated Research Project Centres (AICRP) of subtropical fruits with Central Institute of Subtropical Horticulture (CISH), Lucknow was also supervised and guided from time to time. The work reports were deliberated in the workshop organized at CISH, Lukhnow in June 2008.

Institute organized various programmes at the campus and off the campus to transfer various techniques developed during the period and also participated in programmes organized by the extension departments of various State Governments and the Grape Growers' Associations and exporters and guided their trainees and members respectively in various areas of viticulture.

Scientists of the Institute were invited by the international organizations like Indo-Italian Chamber of Commerce and Udine University of Italy; Manchester, UK; VINIFLHOR of Govt. of France. One scientist was deputed for Post Doctoral position in the Institute of Continental Climate Viticulture and Enology (ICCVE), College of Agriculture, Food and Natural Resources, Division of Food Systems and Bioengineering, University of Missouri, Columbia, USA and another one to Grape Virology Laboratory of Irrigated Agriculture Research and Extension Centre, Prosser, Washington State University, Washington, USA to undergo training. Few scientists were also deputed within country to undergo training/study visits in high technology areas.

Every year the Institute is growing with its revenue generation taking to 48.02 lakhs which was just 16.32 lakhs during 2002-03.

With the limited manpower, the Institute has made all efforts to fulfill the aspirations of the various stakeholders of grape industry in the country. For all this success, the credit goes to the scientific, technical, administrative and supporting staff of the Institute besides the backup support from the Headquarters office at New Delhi.

I would like to place on record the guidance and the encouragement received from Dr. Mangala Rai, Secretary, DARE and Director General, ICAR and Dr. H.P. Singh, Dy. Director General, ICAR. I also appreciate the efforts and help received from my scientific and technical staff members in the preparation of this important document.

Place : Pune
Date : September 2009

(P. G. ADSULE)
Director

कार्यकारी सारांश

राष्ट्रीय अंगूर अनुसंधान केन्द्र की स्थापना 1997 में हुई । लक्ष्यबद्ध कार्यक्रम के अंतर्गत मूलभूत और सामरिक महत्व के अनुसंधान द्वारा अंगूर उत्पादन, उत्पादकता और उपयोग को प्रभावित करने वाले प्रमुख जैविक और अजैविक अवरोधों को सुलझाना, संस्थान का अधिदेश है । इन लक्ष्यों की प्राप्ति के लिए चार मुख्य क्षेत्रों फसल सुधार, फसल उत्पादन, फसल संरक्षण एवं फसलोपरांत प्रौद्योगिकी के अंतर्गत अनुसंधान हो रहा है ।

स्थापना के बारह वर्षों में, संस्थान का चहुँमुखी विकास हुआ है । पिछले सालों में उत्कृष्ट आधारभूत सुविधाओं का विकास हुआ है और सभी प्रयोगशालाएँ अति आधुनिक और संवेदी उपकरणों से सुसज्जित हैं । विभिन्न वित्तीय संस्थानों विशेषत: एपीडा, डीबीटी एवं भाभा परमाणु अनुसंधान केंद्र (भापअनुकें) ने विभिन्न अनुसंधान परियोजनाओं को आर्थिक सहायता दी है । विभिन्न मंचों पर संस्थान के उत्कृष्ट कार्य को सराहना मिली है । संस्थान स्थित राष्ट्रीय संप्रेषण प्रयोगशाला के प्रयासों से पिछले पाँच वर्षों मे निर्यातीत अंगूरों में कीटनाशी अवशेषों में महत्वपूर्ण कमी आयी है और घरेलू उत्पादन में कीटनाशी के प्रयोग को कम किया जा सका ।

पंद्रह संस्थान कार्यक्रमों के अलावा डीबीटी, एपीडा, भापअनुकें एवं भाकृअनुप के नेटवर्क और विभिन्न अनुबन्ध परियोजनाओं के अंतर्गत अनुसंधान हुआ । वर्ष 2008-09 के दौरान विभिन्न क्षेत्रों में संस्थान की उल्लेखनीय उपलब्धियाँ निम्न प्रकार हैं ।

फसल सुधार

12 मदिरा और दो रूटस्टॉक प्रविष्टियों को राष्ट्रीय अंगूर जननद्रव्य संग्रह में शामिल किया गया । इस प्रकार अब कुल प्रविष्टियों की संख्या 458 हो गयी है । एक सौ सत्तावन प्रविष्टियों का दस फलगुणों के आधार पर मूल्यांकन किया गया । बीज वजन सर्वाधिक वंशानुगतिय गुण पाया गया, जो संतति चुनाव में इस गुण की उपयोगिता बताता है । प्रिंसिपल कम्पोनेंट विश्लेषण (पीसीए) द्वारा 157 प्रविष्टियों में भिन्नता के लिए गुच्छा वजन और प्रति गुच्छा मणि संख्या का सर्वाधिक योगदान पाया गया । संस्थान में विकसित विभिन्न संकरों के मूल्यांकन से 16 आशाजनक संकरों की पहचान हुई ।

54 विभिन्न प्रविष्टियों का 22 माइक्रोसेटेलाइट प्राइमर द्वारा विश्लेषण किया गया और फिंगरप्रिंट विकसित किए गये । अंगूर जननद्रव्य के आण्विक मार्कर आँकडों का डेटाबेस बनाने के लिए विभिन्न प्रतिरूपकों के लिए आरेखीय प्रयोक्ता अंतरानीक (GUI), क्रियात्मक परिरूप और कूटलेखन (कोडिंग) किया गया ।

फसल उत्पादन

विभिन्न रूटस्टॉक में सफलतापूर्वक जड़ निकलने और वृद्धि के लिए आई बी ए हारमोन की अलग-अलग मात्रा की आवश्यकता पाई गयी । थॉमसन सीडलैस में कलम लगाने से 6-8 दिन पहले पत्तियाँ निकालने से उन्नत कलम सफलता और निष्पादन पाया गया ।

नौ विभिन्न रूटस्टॉक पर कलमित थॉमसन सीडलैस का विभिन्न मानदण्डों के लिए मूल्यांकन किया गया । 110 आर और डॉगरीज पर कलमित अंगूर बेलों पर अधिक गुच्छा वजन और पैदावर पायी गयी । इन दोनों रूटस्टॉक पर कलमित बेलों की उपज में मणि व्यास और वजन जैसे गुणवत्ता मानदण्ड बेहतर पाये गये ।

कैनोपी प्रबन्धन प्रयोगों में एक तना के मुकाबले द्वि तना बेलों का निष्पादन उत्तमतर पाया गया । विभिन्न ट्रेनिंग पद्धतियों में द्वि कॉर्डन क्षितिज पद्धति वाले अंगूर बेलों में सर्वाधिक गुच्छा वजन, मणि वजन और मणि व्यास पाया गया । कलमित बेलों में चार कॉर्डन पद्धति में सर्वाधिक पैदावार पायी गयी ।

नयी निर्मोचित किस्म नवीन मांजरी के लिए जैवनियंत्रकों के प्रयोग के लिए उचित मात्रा और समय सारणी का मानकीकरण किया गया । प्रति 20 पीपीएम की दर से 6 बीए और जिबरेलिक अम्ल का प्रयोग आदर्श पाया गया । अंगूर बागों में अपतृण के प्रबंधन के लिए हुए परीक्षणों में अनेक नये अपतृणनाशक रसायनों को कारगर पाया गया । इन रसायनों का बेलों पर कोई प्रतिकूल असर नहीं पाया गया ।

उच्च लवणीय तनाव परिस्थितियों में रूटस्टॉक डॉगरीज और सॉल्ट क्रीक के मुकाबले बी 2-56 पर कलमित थॉमसन सीडलैस में अधिक जैवभार और उपज पायी गयी । लवणीय जल से सिंचाई की स्थिति में बी 2-56 में फॉस्फोरस और पोटैशियम की उद्ग्रहण क्षमता बेहतर पायी गयी । अनेक बागानों में अवलोकित पत्ती निर्जीवता और कालेपन का बेल उत्तकों मे निम्न पोटैशियम और उच्च नाइट्रोजन मात्रा से सहसम्बन्ध पाया गया ।

फसल संरक्षण

प्रमुख अंगूर उत्पादन क्षेत्रों के लिए मौसम आधारित व्याधि पूर्वानुमान और व्याधि प्रबंधन के लिए परामर्श संस्थान की वेबसाइट पर उपलब्ध किया गया है । इस वेब पेज को हर सप्ताह अद्यतन किया जाता है । अंगूर किसानों ने इस परामर्शी को अत्याधिक सराहा है । बहुस्थानीय परीक्षणों में अनेक नये फंफुदीनाशक डाऊनी मिल्ड्यू नियंत्रण के लिए सुरक्षित और प्रभावी पाये गये । मणि विकास की अंतिम अवस्थाओं में डाऊनी मिल्ड्यू प्रबंधन के लिए एजोक्सीस्ट्रॉबिन का छिड़काव या गुच्छे डुबो कर प्रयोग सुरक्षित पाया गया । अनेक बागों में अंगूर बेल पत्ती मुडन वाइरस और अंगूर बेल चित्ती वाइरस की उपस्थिति देखी गयी । वाइरस रोग के लक्षण वाले बागों में परिपक्व मणि में कुल घुलनशील पदार्थ की मात्रा कम रही ।

इस वर्ष मुख्य अंगूर उत्पादन क्षेत्रों में थ्रिप्स और मिलीबग का सामान्य और तना बोरर का छिटपुट आपतन पाया गया । सभी विनाशकारी कीटों की उपस्थिति का मौसम मानदण्डों जैसे तापमान और आपेक्षित आर्द्रता से सहसम्बन्ध पाया गया । मिलीबग से प्रभावित बागों से मिलीबग की पाँच और चींटी की आठ विभिन्न प्रजातियाँ एकत्र की गयी । महाराष्ट्र में थ्रिप्स की दो प्रजातियाँ और माइट की एक प्रजाति, लाल मकडी माइट भी प्रमुख विनाशकारी कीट थे । नुकसान पहुँचाने वाली जैसिड और तना बोरर की प्रजातियों की भी पहचान की गयी । आस्ट्रेलिया लेडी बर्ड बीटल, *क्रिप्टोलीमस मॉन्ट्रॉजिरी* के निर्मोचन से मिलिबग फैलाव में कमी हुई । अनेक नये रसायनों का परीक्षण हुआ और उन्हें मुख्य विनाशकारी कीटों के नियंत्रण के लिय उपयोगी एवं *क्रिप्टोलीमस* के लिए सुरक्षित पाया गया ।

एकल मात्रा संमिश्रीत फंफुदीनाशकों ट्राइफ्लोक्सिस्ट्रॉबिन + टेबुकॉनाज़ोल का प्रथम + प्रथम श्रेणी दर गतिज से क्षयन हुआ । इस फंफुदीनाशक का प्रमुख चयापचयक जैविकिय निष्क्रिय पदार्थ ट्राईफ्लोक्सिस्ट्रॉबिन मोनोकार्बोक्सिलिक एसिड पाया गया । फिप्रोनिल का पीएचआई 45 दिन तय किया गया । अंगूर और मदिरा में 185 पदार्थों के लिए बहुअवशिष्ट विश्लेषण विधि का विकास किया गया । यह विधि द्विआयामी गैस क्रोमेटोग्राफी

एवं टाइम ऑफ फ्लाइट मास स्पेक्ट्रोमिट्री पर आधारित है । तीन सौ निर्यातित और पचास देश में उपयोग आने वाले नमूनों का कीटनाशक अवशेषों के लिए परीक्षण किया गया । सभी नमूनों में अवशेषों की मात्रा न्यूनतम अवशिष्ट सीमा से नीचे पायी गयी । भारतीय मदिरा शालाओं से लिए गये मदिरा नमूनों में भी कीटनाशी अवशिष्ट की मात्रा सीमा से नीचे थी।

अंगूर की व्याधियों और कीटों पर एक इलेक्ट्रॉनिक डेटाबेस विकसित किया जा रहा है । वर्ष के दौरान कीटों पर जानकारी इकट्ठा कर वेबपेज बना कर भी दर्शाया गया ।

कटाई उपरान्त प्रौद्योगिकी

प्रारम्भिक प्रयोगों में छँटाई अवधि और फसल भार का ताजी मदिरा और किण्वित मदिरा के गुणों पर प्रभाव पाया गया । किण्वन के लिए प्रयोग की गयी यीस्ट नस्ल का भी मदिरा गुणों पर प्रभाव पाया गया ।

अखिल भारतीय समन्वित अनुसंधान परियोजना (उष्ण कटिबंधीय फल – अंगूर)

संस्थान भारतीय समन्वित अनुसंधान परियोजना (उष्ण कटिबंधीय फल) - अंगूर का तकनीकी समन्वयक है । चार प्रायोजित और तीन स्वैच्छिक केन्द्र इस कार्यक्रम में भाग ले रहे हैं । वर्तमान पंचवर्षीय योजना में मध्यप्रदेश से एक केन्द्र को मंजूरी मिली है। देश के विभिन्न क्षेत्रों के तहत, आनुवांशिक संसाधनों का प्रबंधन और किस्म सुधार, प्रवर्धन, मूलवृंत और कृषि तकनीक, कीट तथा रोग प्रबंधन इस कार्यक्रम की मुख्य गतिविधियाँ हैं ।

प्रौद्योगिकी और सूचना स्थानांतरण

अंगूर की खेती के विभिन्न पहलुओं और अंगूरी मदिरा प्रौद्योगिकी और सूचना अंगूर उद्योग के विभिन्न हितधारकों के लिए प्रशिक्षण कार्यक्रमों के आयोजन उपलब्ध हैं। विभिन्न प्रकाशनों के अलावा क्षेत्र दौरों, उत्पादक संघों में भागीदारी, सेमिनारों, केन्द्र पर संवाद, केन्द्र की वेबसाइट पर जानकारी डालकर तकनिकी स्थानांतरण किया जाता है । वैज्ञानिकों ने अंगूर उत्पादकों, उत्पादक संघों, राज्य सरकारों आदि के द्वारा आयोजित सेमिनारों में भाग लिया । अंगूर उत्पादकों ने क्षेत्र दौरों के दौरान विभिन्न मुद्दों पर वैज्ञानिकों के साथ बातचीत की । उत्पादक केन्द्र द्वारा आयोजित प्रशिक्षण कार्यक्रमों द्वारा लाभान्वित हुए ।

मानव संसाधन विकास

निदेशक और एक वैज्ञानिक ने यूडीन (इटली) का अध्ययन दौरा किया । एक अन्य कार्यक्रम के अंतर्गत निदेशक और एक वैज्ञानिक ने फ्रांस में इनरा, एन्टेव, आई एफ वी और सी वी का दौरा किया । एक वैज्ञानिक की मिसोरी विश्वविद्यालय कोलम्बिया, संयुक्त राज्य अमेरिका के अधीन संस्थान में पी.डी.एफ के लिए प्रतिनियुक्ति हुई । दो वैज्ञानिकों की यू. के. में युरोपिय खाद्य परीक्षण समिट में भाग लेने के लिए और एक वैज्ञानिक की अमेरिका में अंगूर वाइरस पर अध्ययन और प्रशिक्षण के लिए वाशिंग्टन राज्य विश्वविद्यालय के प्रोसर स्थित संस्थान में प्रतिनियुक्ति हुई । दो वैज्ञानिकों ने देश के भीतर प्रशिक्षण प्राप्त किया ।

राजस्व आय

निर्धारित लक्ष्य 48 लाख रूपये के मुकाबले केन्द्र ने 48.02 लाख रूपये की राजस्व आय अर्जित की । यह राजस्व आय प्रशिक्षण, सलाह, अनुबन्धित और सेवाएँ, फार्म उत्पाद और पौधा सामग्री बेच कर हुई । इस राजस्व के अतिरिक्त 17.78 लाख रूपये जमा राशि पर ब्याज के रूप में अर्जित किए गए ।

भावी प्रतिबल क्षेत्र

ऊपज कायम रखना, उत्पाद की गुणवत्ता में सुधार, गुलाबी मणी में कमी, नए रसायनों के विश्लेषण की विधि, गुणवत्ता मदिरा उत्पादन के लिए फसल भार अध्ययन, के शोध पर आनेवाले वर्षों में ध्यान दिया जाएगा ।

Executive Summary

National Research Centre for Grapes was established in 1997 with the mandate to undertake mission-oriented programme involving basic and strategic research for resolving the major biotic and abiotic constraints affecting the grapes production, productivity and utilization. To achieve this, research is carried out in the broad areas of crop improvement, crop production, crop protection and post harvest technology.

During last 12 years of its establishment, the Institute has progressed by leaps and bounds. Excellent infrastructure is developed during last seven years and the laboratories are now equipped with modern and sophisticated equipments. Several agencies specially Agricultural and Processed Food Products Export Development Authority (APEDA), Department of Biotechnology (DBT) and Bhabha Atomic Research Centre (BARC) have funded research projects in their respective field of works. The Institute's contribution towards progress of grape industry in the country was recognized at different fora. Excellent efforts of this Institute as National Referral Laboratory resulted in considerable reduction in pesticide residues in export grapes during last five years as compared to 2003-04 as the first year of the programme. This is also helping in reduction of pesticide use in domestic production.

Besides 15 institute research programmes, which were formulated after thorough understanding of the growers' need and refined time to time after recommendations of the Research Advisory Committee and Institute Research Committee, research was carried out under DBT, APEDA, BARC and Indian Council of Agricultural Research (ICAR) Network projects and also undertook several contract research and consultancy projects. The salient achievements of the Institute's research anf other avtivities during 2008-09 are given below:

Crop Improvement

The national grape germplasm was further strengthened by adding twelve wine and two rootstock genotypes thus bringing the total number of accessions to 458. One Hundred fifty seven accessions were evaluated for 10 fruit characters. Maximum heritability was obtained for seed weight indicating importance of this character for selection. Bunch weight and number of berries per bunch contributed maximum to total variability among 157 accessions as revealed by principal component analysis. Evaluation of several hybrids developed at the Institute identified 16 promising hybrids.

Fifty four different grape accessions were analysed with 22 microsatellite primers and their finger prints were developed. Graphical user interface, functional design and coding for different modules were completed for creating database for molecular marker data of grape germplasm.

Crop Production

Different rootstocks varied in their response to IBA for successful rooting and their growth. Removal of leaves 6-8 days before grafting resulted in improved graft success and performance. Thompson Seedless grafted on nine different rootstocks was evaluated for different parameters. Higher bunch weight and yield was recorded on vines grafted on 110R and Dogridge. Grapes harvested from

vines grafted on these two rootstocks had better quality parameters viz. berry diameter and berry weight.

In canopy management experiments, double stem performed better than single stem. Similarly among different training modification maximum bunch weight, berry weight and berry diameter were obtained with vines trained as double cordon horizontal. However, overall yield was higher in four cordon system.

Bioregulator schedule for newly released variety Manjri Naveen was standardized and application of 6BA @ 20 ppm and GA_3 @ 20 ppm was found optimum.

A few new herbicides were found effective for the management of weeds without any phytotoxicity effect.

Under salinity stress, Thompson Seedless grafted on B2-56 rootstock performed better than those grafted on Dogridge and Salt Creek and resulted in higher biomass and yield. B2-56 was more efficient in P and K uptake under saline irrigation. The leaf necrosis and blackening observed in many vineyards was found to be associated with low potassium and high Na content in vine tissues.

Crop Protection

Weather based disease forecasting for major grape growing regions of country and advisory for disease management is placed on Institute website and updated weekly. The advisory has received overwhelming response from grape growers.

Several new fungicides were tested in multilocational trial and found safe and effective in controlling downy mildew. Application of Azoxystrobin either by spray or bunch dipping was found safe for the management of downy mildew during late stage of berry development. Presence of grape leaf roll virus and grapevine Fleck virus were observed in many vineyards. In symptomatic vineyards TSS of mature berries remained low as compared to healthy vineyards.

Moderate incidence of thrips and mealybugs and sporadic incidence of stem borer was observed in major grape growing regions. The occurrence of all the insect pests were correlated with weather parameters like temperature and relative humidity. Five different species of mealybug and eight different species of ants were collected from mealybug infected vineyards. Two species of thrips and one species of mite, red spider mite were also major pests in Maharashtra. Species of damage causing stem borer and jassids were also identified. Release of Australian lady bird beetle *Cryptolaemus montrouzieri* reduced mealy bug infestation considerably. Several new generation chemicals were tested and found effective against major grape pests as well safe for *Cryptolaemus*.

The dissipation of combination fungicide Trifloxystrobin + Tebuconazole at single dose followed 1st + 1st order rate kinetics. The major metabolite was found to be biologically inactive Trifloxystrobin monocarboxylic acid. The PHI of Fipronil was estimated to be 45 days. A multiresidue analysis

method was optimised for 185 compounds in grape and wine. This method is based on two dimensional gas chromatography (GC × GC, 2-D) hyphenated to time of flight mass spectrometry (TOF-MS). Three hundred export grape and 50 domestic samples were analysed for pesticide residue. In all the samples the residues were found to be below their MRL. Similarly residue levels in samples from Indian wineries were also much below tolerance limit.

An electronic database is being developed for grapevine diseases and insect pests. Information for insect pests is compiled and displayed by creating web page.

Post harvest Technology

Effect of pruning time and crop load on must and wine quality was studied. Preliminary data indicated that both these factors significantly affect quality parameters of wine and must. Quality parameters were also affected by yeast strains used for the fermentation.

AICRP on STF-Grapes

The Institute is the coordinator for All India Coordinated Research Project on Sub-tropical Fruits in respect of Grapes. Four sponsored and three voluntary centres are participating in this programme. One more centre in Madhya Pradesh is sanctioned under the current plan. Management of genetic resources and varietal improvement, propagation, rootstocks and agro-techniques and pest and disease management are main activities of this programme under the different ecoregions of the country.

Transfer of Technology

Transfer of technology and information on various aspects of viticulture and enology is made available to the various stakeholders of grape industry by organizing training programmes, making field visits, participation in growers'/ associations' seminars, interaction with them at the Institute and placing information on the Institute's website apart from publication of bulletins, leaflets and pamphlets. The scientists participated in seminars organized by various agencies like grape growers' associations, state governments, etc. The grape growers directly interacted with the scientists on various issues during the field visits. Growers were also benefited by training programmes organized by the Institute.

Human Resource Development

The Director and one scientists undertook study visits to Italian Chamber of Commerce and University of Udine, Italy and VINIFLHOR, INRA, ENTAV, IFV, and ICV of France. One scientist was deputed for availing Post Doctoral position in the Institute of Continental Climate Viticulture and Enology (ICCVE), under the University of Missouri, Columbia, USA.

Scientists were also deputed to Manchester, UK for acquainting with modern methodology for pesticide analysis and Grape Virology Laboratory at Prosser under the Washington State University,

Washington, USA to know incidence of virus in grape plantings in USA and acquaint with modern techniques for their detection and further analysis.

Two scientists acquired training in their research areas within the country.

Revenue Generation

Gross revenue of Rs. 48.02 lakhs was generated against the target of 48 lakhs through training, consultancy, contract research, services and sale of farm produce. Interest on term deposit receipts of Rs. 17.78 Lakhs was earned apart from the revenue receipts.

Future Thrusts

Sustaining of yield, improving the produce quality, minimization of pink berry, development of analysis methods for new chemicals, crop load studies for production of quality wines will be focus of research in coming year.

Introduction

The National Research Centre for Grapes has now completed 12 years of its establishment at Pune. The Institute is spread over an area of 46.78 ha and functions from Dr G.S. Cheema Bhavan, the Laboratory-cum-Administrative building. Besides main building, National Referral laboratory established with financial assistance from APEDA for monitoring pesticide residues and biocontrol laboratory are also major structures. A polyhouse, glasshouse and FRP houses have been constructed to maintain seedlings and conducting experiments under controlled conditions.

Approximately 16 ha of vineyards have been raised for conducting experiments and establishing National Active Germplasm Site for grapes. Experiments are conducted in the broad areas of grape improvement, production, protection and processing. Vineyards are mostly raised on Y trellises system and irrigated by well laid drip system. To meet the increased water requirement, work on lift irrigation system is in progress and will be in operation soon. A nursery spread over an area of one ha is established. It has polyhouse, shade net and 0.6 ha of rootstock for raising genetically pure, disease free and uniform planting material.

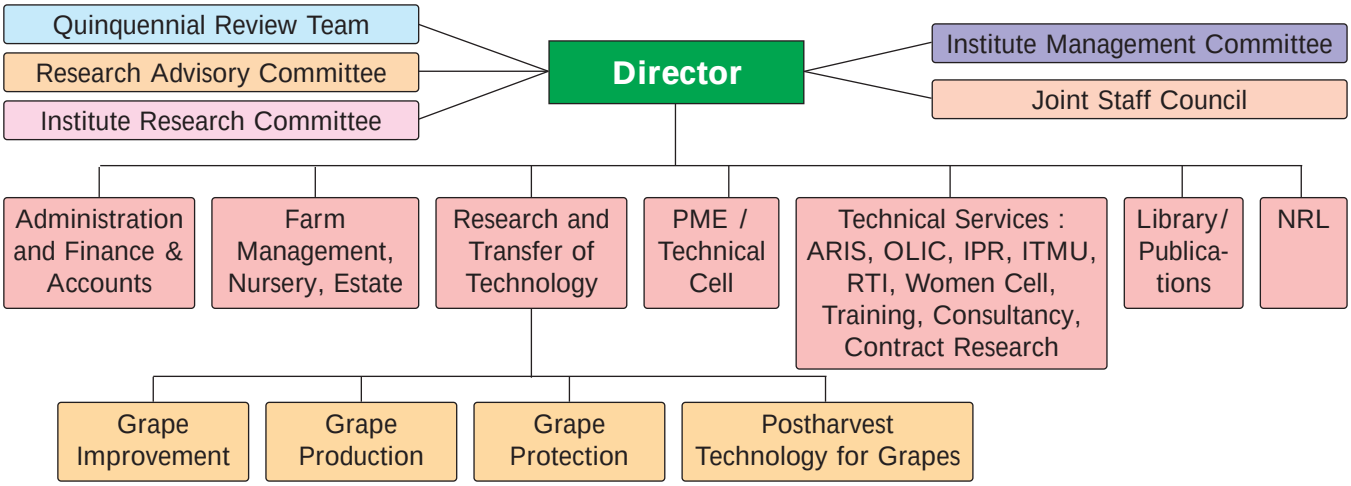
The laboratories of the institute are equipped with state of the art, high precision and high throughput equipments to conduct basic and strategic research.

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.

Thrust areas of research

- Eco-region specific technology generation and extension in continuation.
- Enhancement of water productivity and nutrient use efficiency.
- Climate change and management of stresses.
- Value-added product development, food safety and quality assurance.
- Bio-remediation, bio-fertilization, bio-molecules, bio-fortification, bio-safety, bio-security, and biosensors.
- IT-based decision support systems for technology transfer.



Financial statement

(Rs. in Lakhs)

Sl. No.	Heads	R. E. 2008-09		Expenditure 2008-09		Final Grant		Revenue Generated
		Plan	Non-Plan	Plan	Non-Plan	Plan	Non-Plan	
1.	Estt. Charges	0.00	178.50	0.00	178.50	0.00	178.50	
3.	O.T.A.	0.00	0.05	0.00	0.05	0.00	0.05	
4.	T.A.	4.50	2.00	4.50	2.00	4.50	2.00	
5.	Equipments	59.00	0.00	59.00	0.00	59.00	0.00	
6.	Library books	5.00	0.00	5.00	0.00	5.00	0.00	
5.	Other charges	86.50	55.60	86.50	55.60	86.50	55.60	
6.	Works	10.00	5.00	10.00	5.00	10.00	5.00	
	Total	**165.00**	**241.15**	**165.00**	**241.15**	**165.00**	**241.15**	**48.02 ***

* Revenue of Rs. 48.02 Lakhs was generated against the target of Rs. 48.00 Lakhs through training, consultancy, contract research and services, sale of planting material and farm produce. Interest on term deposit receipts of Rs. 17.78 Lakhs was earned apart from the revenue receipts during 2008-09.

Staff position

Sl. No.	Post	Number of posts		
		Sanctioned	Filled	Vacant
1.	Research & Management Personnel	1	1	0
2.	Scientific	16	13	3
3.	Technical	8	8	0
4.	Administrative	9	9	0
5.	Supportive	7	7	0
	Total	**41**	**38**	**3**

Programme 1. Management of genetic resources of table, wine, raisin, juice and rootstock grape varieties

1.1 Collection and augmentation

During the year 12 accessions of wine varieties grafted on different rootstocks and 2 accessions of rootstock cultivars were introduced from France. The accessions are two clones each of Cabernet Sauvignon and Sauvignon Blanc, Viognier cl.642, SO-4 cl.762, 110 Richter cl.180, Merlot, Chenin Blanc, Cabernet Franc, Muller Thurgue, Sangiovese, Pinot Noir, Chardonnay. The cumulative collection at institute's germplasm is 458 accessions.

1.2 Evaluation of Germplasm

One hundred and fifty seven accessions were evaluated for fruit characters. Fully ripe grape bunches were harvested from 7-8 year old vines maintained in germplasm block and analysed for 10 characters given in Table 1. Phenotypic Coefficient of Variation (PCV) was higher than Genotypic Coefficient of Variation (GCV) for all the 10 fruit characters. Maximum PCV was noticed for seed weight (85.55%) whereas the lowest PCV was recorded for juice pH (7.26%). Similarly, maximum and minimum GCV were obtained in the respective characters. Heritability was found to be maximum in seed weight indicating its importance in selection of superior genotypes with low seed weight especially for table grapes. Estimated genetic advance through selection was also the highest for the seed weight indicating its effectiveness in selection.

Table 1. Variability among fruit characters in 157 grape accessions

Character	Mean	Range	PCV	GCV	H^2	Genetic gain	CD at 5%	CV
Bunch weight (g)	301.51	20-800	55.17	48.18	76.27	86.68	17.99	26.87
Berries/bunch (number)	153.97	10-650	63.02	51.18	65.97	85.63	12.57	36.76
10 Berry weight (g)	30.15	6.5-90.2	54.81	52.48	91.68	103.52	1.06	15.80
Berry diameter (mm)	15.90	10-25.5	18.74	17.73	90.28	34.70	0.22	6.08
Juice per cent (v/w)	62.33	30.5-85.9	14.13	11.20	62.76	8.87	1.10	8.63
Seeds/10 berries (number)	15.02	0-39	74.86	72.24	93.11	69.71	0.66	19.64
Seed weight/10 berries (g)	0.66	0- 2.41	85.55	82.79	93.65	165.05	0.03	21.55
TSS (°B)	19.65	9.4-31.2	18.55	17.70	91.08	34.80	0.24	5.54
Total acidity (%)	0.92	0.30-3	44.43	42.51	91.58	83.80	0.03	12.81
pH	3.54	2.82-4.26	7.26	6.86	89.39	13.36	0.02	2.29

Bunch weight was significantly and positively correlated with berries/bunch, berry weight and berry diameter (Table 2). It was however, negatively correlated with seeds/berry and juice pH. Berries/bunch was negatively correlated with seeds/berry, juice pH, TSS and seed weight. Berry weight was positively correlated with berry diameter, seed weight and juice content but negatively correlated with TSS and titrable acidity. Similarly, berry diameter was positively correlated with seed weight, juice percentage but negatively correlated with TSS and acidity. Juice pH was positively correlated with Juice TSS but negatively correlated with acidity.

Table 2. Correlations among 10 fruit characters of 157 accessions

Character	Berry/ bunch (no.)	Berry weight (g)	Berry diameter (mm)	Juice (%)	Seeds/ berry (no.)	Seed weight (g)	TSS (°B)	Titrable acidity (%)	pH
Bunch weight (g)	0.665**	0.553**	0.492**	0.286**	-0.169**	0.054	0.0384**	-0.086	-0.210**
Berries/ bunch (no.)	—	-0.014	-0.017	0.114*	-0.300**	-0.208**	-0.210**	0.015	-0.233**
10 Berry weight (g)		—	0.859**	0.350**	0.172**	0.451**	-0.313**	-0.197**	0.038
Berry diameter (mm)			—	0.328**	0.150**	0.394**	-0.302**	-0.175**	0.050
Juice per cent (v/w)				—	0.067	0.157**	-0.360**	-0.025	-0.108*
Seeds /10 berries (no.)					—	0.848**	-0.006	0.000	0.211**
Seed weight/10 berries (g)						—	-0.086	-0.021	0.166**
TSS (°B)							—	-0.277**	0.450**
Total acidity (%)								—	-0.432**

Principal component analysis of 157 accessions for fruit characters resulted into well defined seven principal components (PCs) that could explain integration of these characters in explaining the total variabilty (Table 3). PC1 was mainly contributed by bunch weight and berries per bunch whereas PC2 was positively contributed by berries/bunch but negatively contributed by bunch weight and berry weight.

Table 3. Latent vectors of variability among seven principal components

	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7
Bunch weight (g)	0.895	-0.433	-0.084	-0.054	0.032	0.006	-0.001
Berries/bunch (number)	0.443	0.888	0.109	0.029	-0.042	0.000	0.001
Berry weight (g)	0.041	-0.145	0.697	0.459	-0.509	0.018	-0.145
Juice (%)	0.014	-0.022	0.349	0.391	0.844	0.108	-0.006
Berry diameter (mm)	0.007	-0.023	0.106	0.070	-0.067	-0.025	0.989
Seed weight	-0.000	-0.003	0.032	-0.027	-0.002	0.004	0.004
Titrable acidity (%)	-0.000	0.001	-0.003	-0.003	0.006	-0.047	-0.010
pH	-0.000	-0.000	0.003	-0.002	-0.004	0.034	0.013
TSS (°B)	-0.007	0.007	-0.052	-0.042	-0.085	0.992	0.027
Seed number	-0.013	-0.036	0.598	-0.791	0.118	0.008	-0.001

Principal component 1 could explain 86.26 per cent of total variability whereas PC2 explained 12.87 per cent of total variability. Thus PC1 and PC2 were highly effective in explaining total variability among the 10 characters and together explained upto 99.14 percent variability (Table 4).

Table 4. Total percentage variation explained by different principal coordinates

Principal component No.	Latent roots	Percentage variance	Per cent cumulative variance
PC 1	15643911.9	86.265	86.26
PC 2	2334630.0	12.874	99.14
PC 3	70453.7	0.389	99.53
PC 4	44434.3	0.245	99.77
PC 5	35292.3	0.195	99.97
PC 6	4819.6	0.027	99.99
PC 7	1055.5	0.006	100

The scatter diagram (Fig. 1) based on first two components shows the wide variability for 157 accessions. Accession with wide variability can be used in breeding program as parents. However the selection of parents with traits suited for each breeding objective such as for table and wine purpose should be based on the respective standards prescribed.

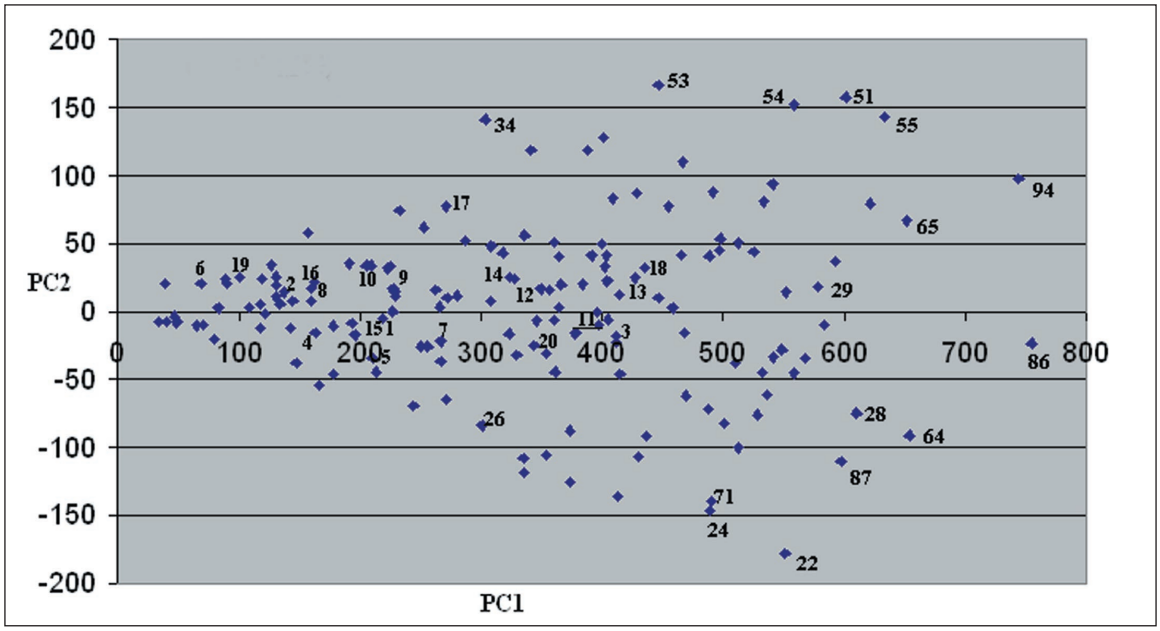


Fig. 1. Two dimensional scatter plot of 157 grape accessions based on first two principal coordinates

Programme 2. Germplasm utilization and genetic enhancement

During the year, evaluation of several F1 hybrids of different crosses was done as indicated in Table 5. Among these 16 were found suited to table / fresh eating purpose and eight of them were seedless and four crosses of Chardonnay were found suited to wine making. Further evaluation is on going.

Programme 3. Application of biotechnological research in grapes

3.1 Molecular characterization of grape germplasm (Partially funded by DBT funded)

Two grape accessions viz. Thompson Seedless and Cabernet Sauvignon were selected as reference material. These two accessions were analysed three times with 25 selected primers and a standard profile was developed.

DNA was extracted from 100 accessions. Fifty-four accessions were analysed with 25 primers but only 22 primers resulted in reproducible bands.

Twenty-two primers detected 256 alleles in 54 accessions with an average of 10.15 alleles per primers. The number of alleles detected by each primer was 4 to 21. The data was analysed and a dendrogram of genetic relationship among these accessions is given in fig 2.

Table 5. Preliminary evaluation of some crosses/hybrids for bunch and berry qualities

Hybrid	Pedigree	Bunch weight (g)	Berries/ bunch (no.)	10 Berry weight (g)	Berry diameter (mm)	Juice (%)	Seed No.	Seed weight (g)	TSS (°B)	Titrable acidity (%)	pH	Utility of hybrid
AH1-18-1	Pusa Navrang x Red Globe	150	40	33.29	18.0	63	10	0.67	17.4	1.20	3.11	Table (C) (T)
AH4-37	*V. parviflora* x Thompson Seedless	230	72	33.91	17.0	71	24	1.03	21.2	0.64	3.60	Table (W)
AH2-8-1	Spin Sahebi x Pandri Sahebi	280	75	41.01	20.0	68	24	1.51	21.0	0.61	3.36	Table (W)
AH2-5-1	Spin Sahebi x Pandri Sahebi	460	86	61.96	22.5	70	14	1.13	17.4	0.70	3.40	Table (W)
AH3-6-1	Spin Sahebi x Superior Seedless	150	54	32.64	17.5	63	15	0.70	20.4	0.88	3.26	Table (W)
B2-15-6	Thompson Seedless x SV 18402	200	68	31.97	15.0	60	12	0.60	15.2	1.16	3.21	Table (W)
AH2-22	Spin Sahebi x Thompson Seedless	270	94	34.71	17.0	70	0	0.0	21.0	0.82	3.25	Table (W)
AH2-20	Spin Sahebi x Kishmish Chernyi	270	145	15.43	16.0	64	0	0.0	20.0	0.75	3.41	Table (C)
AH4-4	*V. parviflora* x Superior Seedless	160	50	43.46	18.3	64	10	0.38	18.4	0.75	3.50	Table (W)
AH2-8	Spin Sahebi x Black Monukka	220	120	12.20	14.8	60	0	0.0	22.0	0.67	3.60	Table (C)
AH2-4	Spin Sahebi x Superior Seedless	240	110	25.19	16.0	64	0	0.0	20.8	0.75	3.48	Table (W)
AH4-15-1	Rangspey x Thompson Seedless	410	189	25.28	17.0	68	0	0.0	20.0	0.74	3.16	Table (W)

Hybrid	Pedigree	Bunch weight (g)	Berries/ bunch	10 Berry weight (g)	Berry diameter (mm)	Juice (%)	Seed No.	Seed weight (g)	TSS (°B)	Titrable acidity (%)	pH	Utility of hybrid
AH1-1-1	Spin Sahebi x Centennial Seedless	210	91	27.76	15.0	62	24	0.77	22.6	0.63	3.89	Table (W)
AH4-12	Rangspey x Thompson Seedless	220	130	24.22	15.0	69	0	0.0	20.2	0.75	3.22	Table (W)
AH4-5	*V. parviflora* x Flame Seedless	250	76	26.89	15.0	66	0	0.0	27.0	0.71	3.41	Table (C)
AH4-23	Spin Sahebi x New Perlette	240	112	24.75	15.0	73	0	0.0	20.0	0.80	3.05	Table (W)
AH3-25 R	Pusa Navrang x Chardonnay	147	144	9.67	12.0	60	27	0.92	16.6	1.08	3.25	Wine (C) (T)
AH1-23-1	Pusa Navrang x Gulabi	110	69	20.68	14.0	69	10	0.89	16.8	2.01	2.81	Wine (C) (T)
AH4-1-5	Chardonnay x Arkavati	170	124	14.03	10.0	68	16	0.60	18.0	0.97	3.57	Wine (W)
AH3-27	Chardonnay x Pusa Navrang	140	130	11.43	11.8	64	26	0.84	20.0	0.72	3.50	Wine (W)

Note : C: Coloured, W: White, T: Teinturer

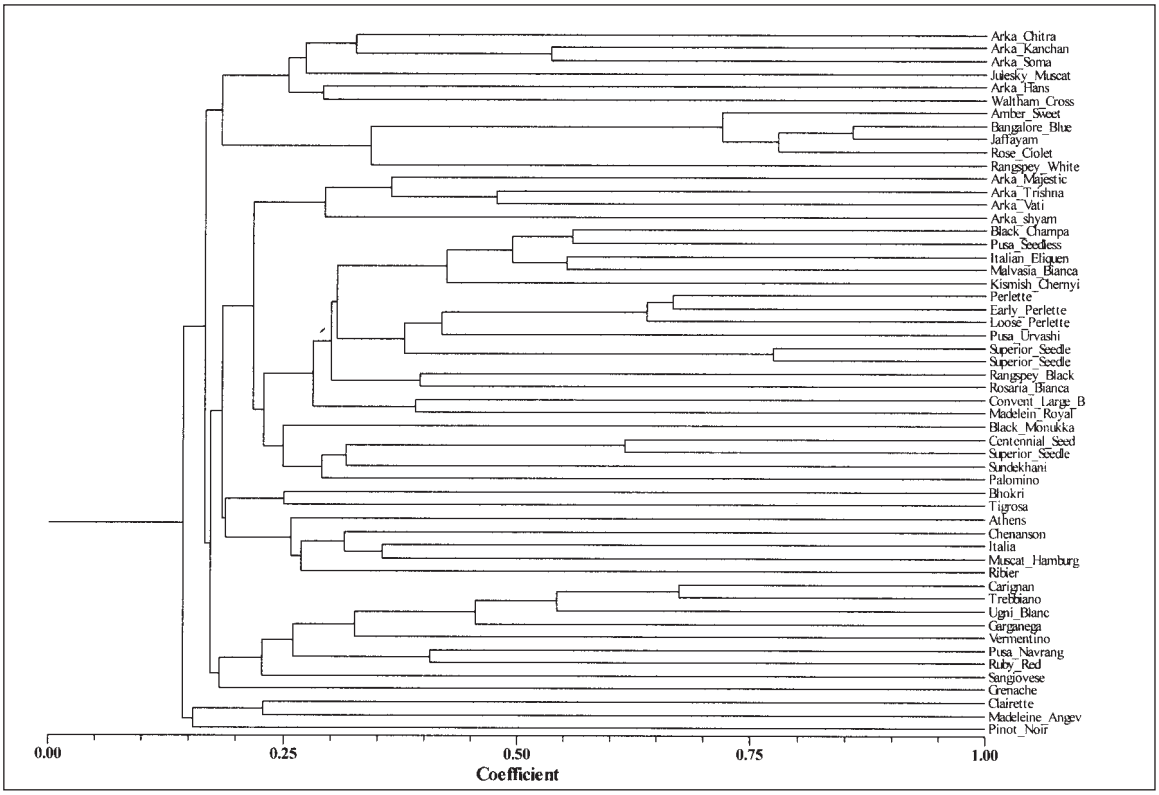


Fig. 2. Dendrogram of genetic relationship among grape accessions.

Several accessions were found to be chimeric as evident by presence of three alleles at many locus (Fig. 3). Chimerism was observed in Kishmish Chernyi at VVIP77, Pusa Navrang at VMC8b5, Trebbiano and Walthom Cross at VMC7f2, Arka Shyam at VMC4f8, Pusa Urvashi, Rangspey Black, Julesky Muscat, Loose Perlette and Madelein Royal at VVS2, Arka Majestic, Arkavati, Arka Shyam, Athens, Black Champa, Black Monukka, Centennial Seedless, Kismish Chernyi, Madeleine Angevine, Superior Seedless, Malvasia Bianca de Raporis at VVIV37, Pusa Seedless at VVIB01, Superior Seedless, Ugni Blanc at VVII52, Arka Hans, Arka Shyam, Arka Soma, Grenache, Rosaria Bianca at VVIN33 and Chenanson, Malvasia Bianca de Raporis at VVMD32.

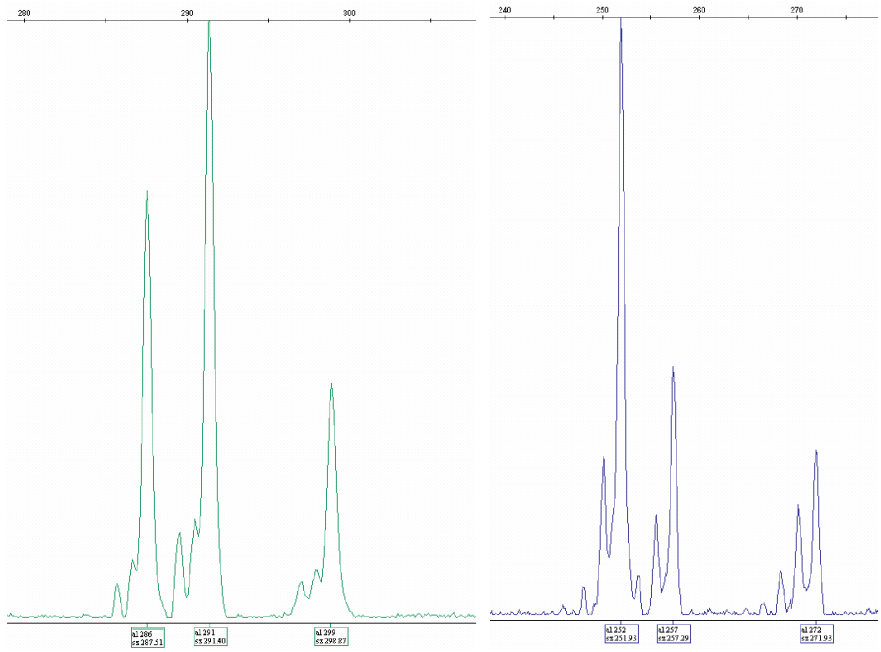


Fig. 3. Occurrence of chimerism

Programme 4. Development of propagation and nursery techniques

4.1 Standardization of IBA concentration for rooting success and growth in different grape rootstocks.

This experiment was conducted to standardize IBA concentration for successful rooting and growth in different rootstocks viz., Dog Ridge, 1613 C, St. George, 140 RU, 41 B and Freedom. Different concentrations of IBA viz. T1: 2000 ppm; T2: 1500 ppm; T3: 1000 ppm; T4: 750 ppm and T5: No IBA was used to pretreat hardwood cuttings before planting in the poly bags. The observations on days taken for bud sprout, shoot and root parameters were recorded 120 days after planting.

Among the different rootstocks, 1613C was early to sprout (8.03 days) with 1000 ppm as compared to all other rootstocks. However, Dog Ridge and Freedom sprouted at 2000 ppm IBA concentration. Data on shoot length and leaf area recorded 120 days after planting is given in table 6. Maximum shoot length was recorded in Freedom (47.97 cm) with 750 ppm IBA followed by St. George with 1500 ppm. Control cuttings had minimum shoot length in all rootstocks. Highest leaf area was recorded in 1613C in all treatments followed by Freedom and 140 RU. The highest root length was recorded in 1613C (12.51cm) treated with 1000 ppm IBA whereas root diameter and number of root primordial were highest in 41B followed by 140RU. Thus, different rootstocks require different IBA concentration for multiplication through hardwood cuttings.

Table 6. Effect of different IBA concentration on growth parameters

Treatments	Shoot length (cm)						Leaf area (cm^2)					
	Dog Ridge	1613C	St. George	140 RU	41B	Freedom	Dog Ridge	1613C	St. George	140 RU	41B	Freedom
T1	13.03	7.50	16.52	3.96	4.51	25.50	26.51	28.94	17.66	16.75	22.04	22.95
T2	8.83	6.42	41.80	4.20	4.92	32.50	16.17	32.47	24.82	15.87	17.25	16.30
T3	8.55	8.22	12.73	3.96	3.44	39.62	18.20	36.72	20.55	15.16	16.94	18.79
T4	10.05	6.74	15.28	4.24	3.51	47.97	17.60	30.10	20.72	14.21	12.89	16.20
T5	7.69	5.23	12.39	3.04	2.94	13.50	15.26	20.57	15.60	14.45	8.46	14.70
SEM±	0.081	0.116	0.215	0.047	0.061	0.564	0.192	0.375	0.141	0.216	0.274	0.333
CD±	0.18	0.25	0.47	0.10	0.13	1.23	0.42	0.82	0.90	0.47	0.60	0.72
Significance	**	**	**	**	**	**	**	**	**	**	**	**

4.2 Effect of leaf removal on grafting success in Thompson Seedless grapes

This experiment was conducted to study the effect of leaf removal on grafting success in Thompson Seedless grapes. Leaves were removed from the canes of mother vine at 8, 6, 4, 2 days before grafting and was compared with control canes without removal of leaves.

Significant differences were recorded among the different treatments. Bud sprouting was the earliest in leaf removal at 8 days before grafting (15.39 days) followed by 6 days (17.80) and 4 days (19.77 days) respectively. Maximum days were taken for sprouting under no leaf removal treatment. The shoot length, shoot diameter, internodal length and stock: scion was more in the same treatments as compared to others since the bud sprouting was early. Significant differences were recorded for percent successful grafts. The treatment of leaf removal before 8 days of grafting resulted into 98 per cent success as compared to control treatment (74 per cent). Higher shoot vigour in terms of shoot length was also recorded in the same treatment. Considering the results it is recommended to remove leaves 6-8 days before grafting for successful grafting and better performance.

4.3 Rooting behavior and biochemical constituents in grape rootstock

Biochemical constituents of rootstock mother vines influence the rooting ability in response to IBA treatment of cuttings. Mother vines of four rootstocks were analysed for different biochemical constituents. Total phenol was the highest in Dog Ridge (22.4 mg/g), while it was the least in Freedom (11.10 mg/g) (Fig 3). Protein content also varied significantly and the maximum protein content was recorded in Freedom (56.7 mg/g) while minimum protein content (37.85 mg/g) was recorded in 110R. Rootstocks differed significantly for their total carbohydrate content and maximum total carbohydrate was estimated in Freedom (51.9 mg/g) which was on par with 140 RU. Total root length was also different among the rootstocks, with maximum root length at 90 days after planting was observed in Dog Ridge (123.87 cm), followed by Freedom (84.11 cm). Dog Ridge had the highest PPO activity during the initial stages of the rooting process and it differed significantly in 110 R (Fig. 4).

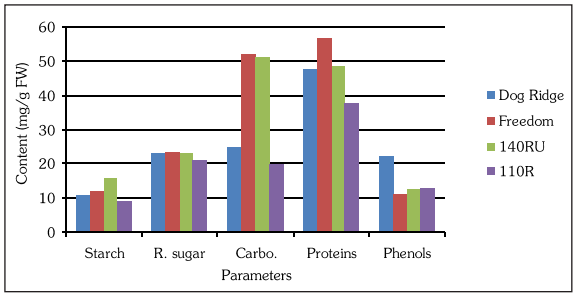


Fig 3. Biochemical constituents in different rootstocks

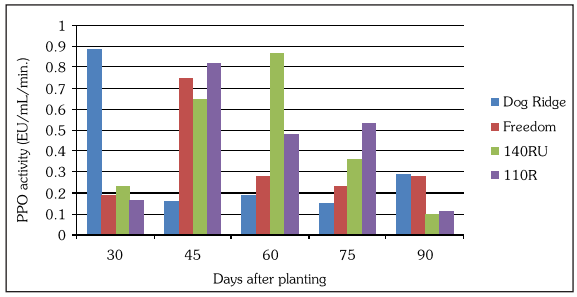


Fig 4. PPO activity (EU/mL/min.) in grape rootstocks during rooting

Programme 5. Use of rootstocks for grape cultivation

5.1 Performance of Thompson Seedless grafted on different rootstocks

5.1.1 Vegetative and reproductive parameters

Thompson Seedless grafted on nine different rootstocks and own rooted vines was studied for vegetative, reproductive and biochemical status in different parts. The performance of these vines differed significantly for various characters.

Data in table 7 indicated that, the higher October pruned biomass was obtained in vines grafted on Dog Ridge, Salt Creek and 110R rootstocks while it was less in own rooted vines. The vines grafted on Dog Ridge, Salt Creek and SO4 rootstocks were late to sprout as compared to sprouting achieved in own rooted vines. Shoot diameter (cane thickness) plays an important role for the storage of food material. Significant differences were recorded in cane diameter and maximum cane diameter was recorded on Dog Ridge grafted vines. Maximum shoot length was recorded in vines grafted on St. George rootstock followed by Dog Ridge and 110R rootstock. The vines grafted on 110R had the maximum bunches per vine as compared to vine grafted on other rootstocks.

5.1.2 Yield and quality parameters

Data on yield and quality parameter of Thompson Seedless grafted on different rootstock as compared to own rooted vines is presented in table 8. Higher bunch weight was recorded in vines grafted on all rootstocks. The same trend was also observed for berry weight. Berry diameter and berry length also differed significantly among the different rootstocks studied. Maximum berry diameter and length was recorded in the vines grafted on rootstocks as compared to own rooted vines. The differences for total soluble solids (TSS) among the vines grafted on different rootstocks were non significant.

Rootstocks play an important role in overall production of vines. Higher yield indicates the raisin recovery percentage. Significant differences were recorded for raisin recovery. The raisin recovery was highest in the vines grafted on 110R followed by 1613C, 99R and SO4.

Table 7. Effect of different rootstocks on growth parameters

Treatments	October pruning wt. (g)	No. of days for bud sprouting	Cane diameter (mm)	Shoot length (cm)	No. of bunches / vine	Average bunch wt. (g)
Dog Ridge	967.21	23.16	8.25	108.49	44.40	337.20
Salt Creek	936.43	18.04	7.85	103.02	42.33	299.00
St. George	720.02	17.32	7.37	110.10	37.46	250.53
1613 -C	580.18	13.28	6.91	74.07	37.53	286.33
110 R	880.84	14.68	8.15	101.51	64.26	348.61
B2 / 56	654.03	14.12	7.88	95.24	42.08	259.26
99 R	702.08	18.68	7.76	93.42	53.06	251.46
1103 P	670.00	16.12	7.35	96.68	41.13	297.86
SO4	650.07	18.36	6.98	87.57	34.66	267.40
Own Root	524.13	10.76	7.26	85.57	54.00	243.12
SEM	45.285	0.346	0.202	4.055	2.303	16.470
CD at 5%	134.554	1.028	0.601	12.049	6.844	48.937
Significance	**	**	**	**	**	**

Table 8. Effect of different rootstocks on yield and quality parameters.

Treatments	Av. bunch wt. (g)	50 berry wt. (g)	Berry diameter (mm)	Berry length (mm)	TSS (^{0}Brix)	Raisin recovery (%)	Yield/ vine (kg)
Dog Ridge	337.20	157.63	16.13	18.66	21.20	27.47	13.17
Salt Creek	299.00	139.43	14.80	16.83	21.06	28.50	11.32
St. George	250.53	117.13	15.63	18.06	20.20	27.62	6.59
1613 -C	286.33	131.36	15.03	17.73	21.53	28.97	6.35
110 R	348.61	158.81	16.23	18.83	21.13	29.90	16.35
B2 / 56	259.26	124.80	14.56	16.80	21.33	28.02	8.90
99 R	251.46	124.56	14.70	18.36	20.73	28.58	11.45
1103 P	297.86	136.36	15.40	18.33	20.73	27.44	11.02
SO4	267.40	130.10	15.20	17.03	20.93	28.78	7.92
Own Root	243.12	119.26	14.60	16.10	21.26	26.02	9.38
SEM	16.470	5.297	0.353	0.503	0.338	0.119	0.65
CD at 5%	48.937	15.738	1.050	1.495	1.005	0.353	1.92
Significance	**	**	**	*	NS	**	**

5.1.3 Biochemical changes during berry development

Swollen buds, leaf and berry samples of Thompson Seedless grafted on nine different rootstocks and own rooted vines were collected at different growth stages viz. bud stage, third leaf stage, 3-4 mm, 6-8 mm, veraison and harvesting to study the influence of rootstocks on changes in biochemical composition during different growth stages.

In leaves, total phenol content reduced from three leaf stage to 6-8 mm berry stage and then increased at veraison stage, an important berry development stage. The phenol content reduced at harvest. However, in berries, the total phenols increased from flowering stage to 6-8 mm berry stage and then reduced till harvest (Fig 5 and 6).

Reducing sugar in leaf increased from three leaf stages till veraison stage and then found to be reduced at harvest. However, in berries it increased from 3-4 mm to harvest (Fig 7 and 8). Starch in leaf increased from 3-4 mm to veraison stage and then reduced in all the rootstocks studied. However, in berries, starch in general increased from 3-4 mm to 6-8 mm berry stage (Fig 9 and 10).

Status of 20 individual amino acids (ppm) was also estimated in all the 9 rootstocks at all growth stages from leaves as well as berries. Of the 20 amino acids studied, almost all were present at all growth stages except methionine which was present only in the harvesting stage leaves. The status of growth regulators belonging to cytokinins and auxin groups (in leaf and berries) was studied. Different growth regulators (Choline, Zeatin, 6-BA, Isoprothialane, Paclobutrazole, GA, NAA, and Kinetin etc.) were estimated at different berry development stages.

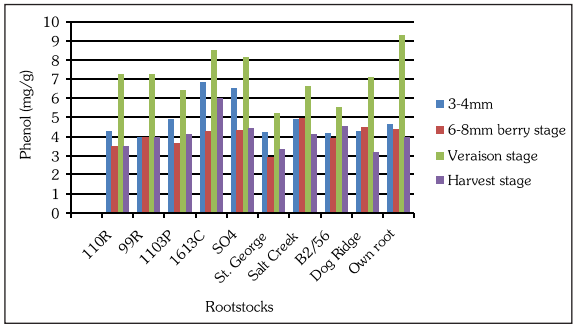


Fig 5. Phenolics changes in leaf at different berry development stages.

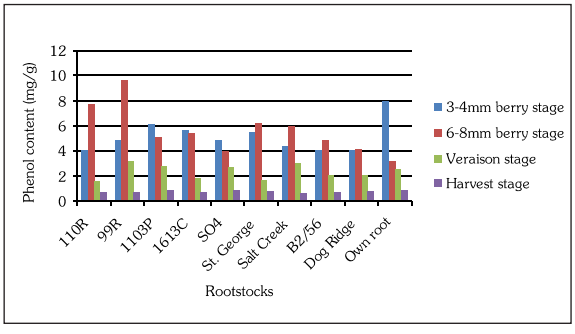


Fig 6. Phenolics changes in berries at different berry development stages.

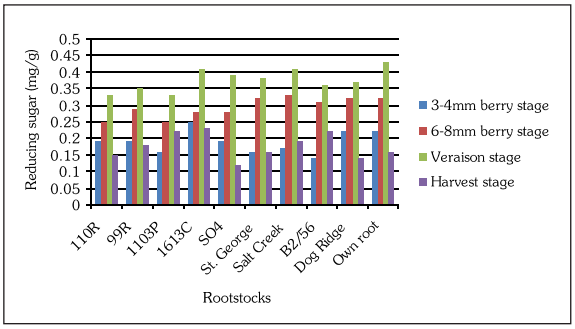


Fig 7. Changes in reducing sugars in leaves at different berry development stages.

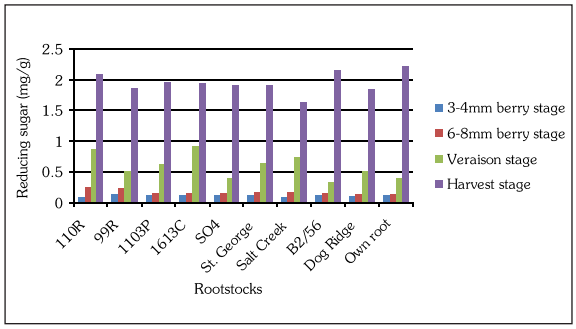


Fig 8. Changes in reducing sugars in berries at different berry development stages.

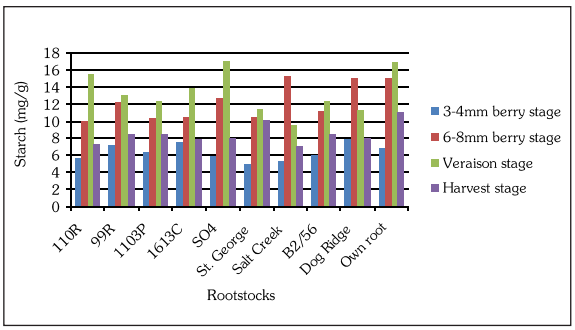


Fig 9. Changes in Starch in leaves at different berry development stages.

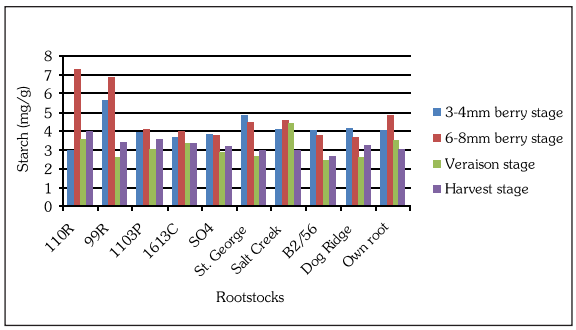


Fig 10. Changes in Starch in berries at different berry development stages.

Programme 6. Horticultural practices for quality and yield in table and wine grapes

6.1 Source: Sink in relation to different training modifications in Tas-A-Ganesh grapes

After fruit pruning, source: sink relationship plays an important role in production of quality bunch. The different parts of vines viz., roots, stems, cordons, canes, leaves etc. act as a source. The food material stored in different parts of vine is then supplied to the sink (the developing bunch). To study the status of biochemical parameters in relation to different growth and yield attributes, the experiment was conducted on Tas-A-Ganesh variety grafted on single and double stem and was compared with own rooted vines.

6.1.1 Flat roof gable system

A. Effect of number of stems on growth parameters

The data in table 9 indicated that the pruned biomass during back pruning was higher in double stem (4.28 kg) than in single stem (3.90 kg). The vines placed horizontally with four cordons produced

more biomass as compared to other modifications. Higher shoot length (102.63 cm), shoot diameter (8.51 mm) was recorded in the double stem (single cordon) maintained vines as compared to the single stem. Higher fruitfulness was recorded in the vines on double stem as compared to single stem grafted vines. In single stem, higher fruitfulness was recorded in horizontally placed cordon (SCH) whereas in double stem group, it was in double cordon horizontal. (Table-9)

Table 9. Effect of number of stems on growth parameters and fruitfulness in Tas-A-Ganesh vine

Treatment	April pruned biomass (kg)			Shoot length (cm)			Shoot diameter (mm)			% Fruitful canes		
	Single stem	Double stem	Mean B	Single stem	Double stem	Mean B	Single stem	Double stem	Mean B	Single stem	Double stem	Mean B
SCH	3.45	4.31	3.88	84.91	131.01	107.98	8.04	9.26	8.65	84.30	82.35	83.33
SCD	4.14	3.61	3.87	77.61	132.67	104.99	7.65	8.87	8.26	79.30	82.10	80.70
DCH	3.79	4.37	4.07	75.53	98.83	87.18	7.68	8.20	7.94	80.10	85.15	82.63
DCD	4.25	4.33	4.29	75.07	86.43	80.75	8.17	8.61	8.39	75.60	78.00	76.80
FCH	3.95	4.89	4.42	68.16	86.80	77.48	7.56	8.10	7.83	68.30	69.50	68.90
FCD	3.81	4.21	4.01	69.71	80.31	75.01	7.30	8.02	7.66	66.80	59.25	63.03
Mean A	3.90	4.28	—	75.16	102.63	—	7.73	8.51	—	75.73	76.06	—
	A	B	A×B	A	B	A×B	A	B	A×B	A	B	A×B
SEM ±	0.13	0.22	0.31	1.76	3.06	4.32	0.14	0.25	0.35	1.10	1.92	2.72
CD at 5%	0.36	NS	NS	5.08	8.80	12.44	0.41	NS	NS	3.19	5.53	NS

B. Effect of plant type on growth parameters

The study was conducted to compare the performance of Tas-A-Ganesh grafted on Dog Ridge rootstock and was compared to own rooted vines. Data in table 10 indicated that higher pruned biomass was recorded in Tas-A-Ganesh vines grafted on Dog Ridge rootstock as compared to the vines on their own roots. Increase in shoot length was recorded in grafted vines as compared to the own rooted vines. Among the different training modifications, single cordon (placed horizontally) recorded highest shoot length as compared to other training modifications. Higher number of canes per vine was recorded in grafted vines than in the own rooted vines. However, higher fruitful canes were recorded in own rooted vines than in the grafted vines.

Table 10. Effect of plant type (own root vs. grafted) on growth parameters and fruitfulness in Tas-A-Ganesh

Treatment	April pruned biomass (kg)			Shoot length (cm)			Number of canes/vine			% Fruitful canes		
	Own root	Grafted	Mean B	Own root	Grafted	Mean B	Own root	Grafted	Mean B	Own root	Grafted	Mean B
SCH	2.37	3.45	2.91	76.61	84.90	80.76	46.00	47.75	46.87	80.10	80.60	80.35
SCD	2.87	4.13	3.50	67.84	77.35	72.60	41.75	51.35	46.55	79.30	77.65	78.47
DCH	2.62	3.95	3.28	73.61	75.53	74.57	56.50	59.45	57.97	84.30	74.40	79.35
DCD	2.91	4.25	3.58	65.95	57.06	70.51	56.10	61.25	58.67	75.60	74.15	74.87
FCH	3.08	4.30	3.69	57.70	66.80	62.24	66.75	80.15	73.45	68.30	70.20	69.25
FCD	3.04	3.81	3.42	55.62	69.70	62.66	66.15	76.80	71.47	66.80	67.25	67.02
Mean A	2.81	3.98	—	66.22	74.90	—	55.54	62.79	—	75.73	74.04	—
	A	B	A×B	A	B	A×B	A	B	A×B	A	B	A×B
SEM ±	0.099	0.17	0.24	1.59	2.75	3.90	1.57	2.72	3.84	2.04	1.17	2.88
CD at 5%	0.28	0.49	NS	4.58	7.93	NS	4.52	7.83	NS	5.88	NS	NS

C. Biochemical status in relation to number of stems

The different parts of vine (stem, cordons, canes, leaf, roots etc.) play an active role in storing the food material. During the period of bunch development, the food material is transported from source to the sink.

Significant differences were recorded for protein content in leaf and petiole. The protein content in leaves in grafted vines was reduced from 4-6 mm berry stage (34.26 mg/g) to 10-12 mm berry stage (18.85 mg/g) whereas in own rooted vines it was reduced from 36.90 mg/g to 19.16 mg/g and again increased till harvest. At 4-6 mm berry stage, highest protein content in leaves was recorded in double cordon horizontal (38.60 mg/g) placed and was followed by single cordon horizontal (38.53 mg/g). In general, the starch content in leaves in own rooted vines increased from 4-6 mm (3.99 mg/g) to 10-12 mm stage (4.06 mg/g) and then reduced till harvest. However, the carbohydrate content in berries reduced from 4-6 mm to 10-12 mm berry stage and then reduced till harvest (4.03 mg/g).

D. Effect of number of stems on yield and quality parameters

Yield and quality parameters like number of bunches per vine, average bunch weight, berry diameter and berry length were recorded on Tas-A-Ganesh grafted on single and double stem and data is presented in table 11. Significant differences were recorded for yield characters. Maximum bunches per vine were recorded in four cordon diagonal (FCD) in single stem as compared to double stem. Among the training modifications in single stem, FCD recorded maximum bunches, whereas in double stem, it was in four cordon horizontal (FCH). With the increase in number of cordons, the

bunch number increased in both the stem groups. Maximum bunch weight, 50 berry weight and berry diameter was recorded in double cordon horizontal (DCH) in single and double stem.

Significant differences were recorded for yield per vine. Higher yield per vine was recorded in double stem as compared to single stem. Among the different modifications, horizontally placed double cordon produced higher yield of 18.4 kg and 18.10 kg in single and double stem respectively.

Table 11. Effect of number of stems on yield and quality parameters

Treatment	No. of bunches/vine			Bunch weight (g)			Berry diameter (mm)			Yield/vine (kg)		
	Single stem	Double stem	Mean B	Single stem	Double stem	Mean B	Single stem	Double stem	Mean B	Single stem	Double stem	Mean B
SCH	34.56	44.52	39.54	318.72	326.40	322.56	16.50	17.07	16.78	11.01	14.71	12.86
SCD	35.40	36.78	36.09	308.07	307.77	307.91	15.68	16.75	16.21	10.87	11.33	11.10
DCH	51.08	52.03	51.56	354.86	360.40	357.62	16.10	16.98	16.54	18.10	18.40	18.25
DCD	44.46	46.84	45.65	350.92	347.69	349.30	15.90	16.97	16.40	15.51	18.09	16.80
FCH	65.40	64.24	64.82	235.92	267.19	251.55	15.38	14.75	15.06	15.43	17.19	16.31
FCD	70.68	55.96	63.32	223.17	270.58	246.88	14.88	15.50	15.19	15.78	13.76	16.76
Mean A	50.27	50.06	—	298.61	313.33	—	15.73	16.32	—	14.45	15.58	—
	A	B	A×B	A	B	A×B	A	B	A×B	A	B	A×B
SEM ±	1.00	1.73	2.45	3.28	5.68	8.02	0.11	0.20	0.28	0.26	0.44	0.63
CD at 5%	2.88	4.99	7.06	9.43	16.34	23.11	0.32	0.57	0.81	0.74	1.29	1.82

E. Effect of plant type on yield and quality parameters

Significant differences were recorded in yield parameters among the plant type and also in different training modifications. The data is given in table 12. Higher average bunch weigh, 50- berry weight, berry diameter and yield per vine was recorded in the grafted vines as compared to the own rooted vines. Among the different training modifications, higher bunch weight was recorded in double cordons (placed horizontally) in grafted vines as compared to the single cordon (diagonally placed) in own rooted vines. Higher yield of 18.49 kg/vine was recorded in four cordons (placed horizontally) in grafted vines as compared to four cordons (placed diagonally) in own rooted vines.

F. Effect of different rootstocks on raisin quality

Raisins were analyzed for its biochemical constituents. Data in table 13 reveal that highest quantity of carbohydrate was recorded in the raisins of the vines grafted on 110R followed by Dog Ridge and 99R rootstocks with least carbohydrate content in the raisins of the SO4 grafted vines. Raisins from the vines on 99R rootstock recorded maximum starch and reducing sugar content compared to own rooted and vines on other rootstocks. Least starch and reducing sugar content was recorded in the raisins of vines grafted on 1613C and Dog ridge rootstocks, respectively. Total sugar content

contributes directly to the sweetness of the raisins. More quantity of phenol was recorded in the raisins of the vines grafted on 1613C rootstock followed by SO4 and 99R rootstocks. Presence of higher amount of phenolic compounds in addition to protein, starch etc. may help the raisins to maintain better quality and improve shelf life. Significant differences were recorded for protein content in the raisins obtained on different rootstocks. Higher protein was recorded in the raisins from SO4 grafted vines as compared to the vines on 110R and 99R rootstock. However, minimum protein was recorded in the raisins from own rooted vines.

Table 12. Effect of plant type on yield parameters in Tas-A-Ganesh grafted vines

Treatment	Average bunch wt. (g)			50 Berry wt. (g)			Berry diameter (mm)			Yield/vine (kg)		
	Own root	Grafted	Mean B	Own root	Grafted	Mean B	Own root	Grafted	Mean B	Own root	Grafted	Mean B
SCH	277.62	318.73	298.17	122.13	137.73	129.93	16.50	17.08	16.79	11.26	11.01	11.12
SCD	287.97	308.07	298.02	125.30	136.93	131.11	15.68	16.75	16.21	10.88	10.87	10.88
DCH	267.10	354.86	310.98	118.98	150.69	134.83	16.10	16.98	16.54	11.35	18.10	14.73
DCD	220.54	350.93	285.73	112.48	136.55	124.52	15.90	16.89	16.40	10.25	17.27	13.76
FCH	223.40	235.93	229.66	111.33	119.88	115.60	15.38	14.75	15.06	9.91	18.49	14.20
FCD	207.18	223.18	215.17	121.37	116.65	119.01	14.88	15.50	15.19	10.30	18.04	14.17
Mean A	247.30	298.61	—	118.60	133.07	—	15.74	16.32	—	10.65	15.63	—
	A	B	A×B	A	B	A×B	A	B	A×B	A	B	A×B
SEM ±	3.27	5.66	8.00	1.21	2.09	2.95	0.12	0.20	0.28	0.15	0.27	0.38
CD at 5%	9.41	16.30	23.05	3.47	6.01	8.50	0.33	0.58	NS	0.44	0.77	1.10

Programme 7. Nutrient and soil management in grapes

7.1 Rootstock effect on ion accumulation in Thompson Seedless vines exhibiting leaf blackening and necrosis symptoms

Irrigation of the vines with saline water resulted in blackening and necrosis of leaves leading to leaf fall in Thompson Seedless vines raised on their own roots and vines grafted on Dogridge and Salt Creek. However, such visual symptoms were not observed in vines grafted on B2-56 and 1613C. During ripening of grape berry stage, leaf blackening and necrosis symptoms started appearing on the upper leaves on a shoot in some of the scion stock combinations which progressed downwards as the season progressed in contrast to classical K deficiency where the symptoms appear first on basal leaves. The ion accumulation in different tissues of vine parts on different stock scion combinations was studied in the vegetative growth which emerged after fruit pruning in the cropping season 2007-2008 at the time of harvest. Yield and biomass was also recorded.

Table 13. Effect of rootstock on raisin quality

Treatments	Carbohydrate (mg/g)	Starch (mg/g)	R. sugar (mg/g)	Phenol (mg/g)	Protein (mg/g)
Dog Ridge	282.64	14.03	3.55	2.88	22.69
Salt Creek	262.77	9.32	4.42	2.75	21.45
St. George	260.64	10.61	4.82	2.42	23.45
1613 C	261.45	7.13	5.15	3.18	26.70
110 R	286.34	14.59	6.12	2.67	27.46
B2 – 56	267.89	11.42	5.76	2.79	24.89
99 R	271.37	15.30	6.80	2.87	27.36
1103 P	264.65	12.66	5.16	2.74	21.01
SO4	258.76	13.12	6.29	2.88	28.50
Own Root	279.34	7.04	5.14	2.27	19.78
SEM	2.364	0.654	0.178	0.046	0.774
CD at 5%	7.025	1.942	0.529	0.136	2.301
Significance	**	**	**	**	**

Biomass

Significantly higher biomass (petiole + blades + cane), yield and higher number of bunches per vine was recorded in B2-56/Thompson Seedless (TS) graft combination compared to other stock scion combination viz. 1613C/Thompson Seedless, Dogridge/Thompson Seedless, Salt Creek/ Thompson Seedless and own rooted vines. Average bunch weight was more in Dogridge rootstock as compared to own rooted vines.

Nutrient content

Phosphorus : B2-56 rootstock had significantly more P concentration in leaf blades than all other stock scion combinations while vines grafted on Dogridge and Salt Creek rootstock had significantly lower P content in petioles compared to vines grafted on B2-56 rootstock and raised on own roots. Vines raised on their own roots and grafted on B2-56 rootstocks had significantly higher P concentration in petiole, blade and canes than Salt Creek and Dogridge. However, Salt Creek resulted in lower P content in all the vine parts.

Nitrogen : All the rootstocks increased the blade N content significantly compared to own rooted vines. B2-56 rootstock resulted in significantly higher N concentration (1.62%) in leaf blades than all other stock scion combinations. Highest N content in petioles (0.618 %) was in vines grafted on B2-56 rootstock. In canes 1613C resulted in significantly higher N content compared to other stock/scion combinations.

Potassium : Vines raised on their own roots, Dogridge and Salt Creek rootstock exhibiting leaf blackening and/or necrosis symptoms had lower K content than vines grafted on B2-56 and 1613C rootstock which had healthy leaves. Vines grafted on Salt Creek exhibited severe necrosis and leaf blackening symptoms which corresponded to lowest K content in the vine tissues. Compared to own rooted vines, significantly higher K content was found in the blade of vines grafted on B2-56 and 1613C rootstocks whereas the difference among own rooted and vines grafted on Dogridge and Salt Creek rootstock were not significant. Similar trend was observed in case of petioles and canes.

Sodium : Highest Na concentration was observed in the petioles of own rooted vines. All the rootstocks except Dogridge resulted in significantly lower Na content in petioles. Canes of vines grafted on B2-56, Salt Creek and 1613C rootstock also contained significantly lower Na content than own rooted vines. Vines grafted on B2-56 and 1613C contained significantly lower sodium content in blades (0.264 - 0.276%) than own rooted vines and those grafted on Dogridge and Salt Creek rootstock (0.534 - 561%). In blades highest Na concentration was in the vines grafted on Dogridge rootstock. No significant differences were observed in blade Na content in vines grafted on Dogridge and Salt Creek and own rooted vines.

K:Na ratio : The vines exhibiting necrosis and leaf blackening had lower K:Na ratios compared to healthy vines. Lowest K: Na ratio was observed in case of Thompson Seedless/Salt Creek combination and highest in case of Thompson Seedless/B2-56 graft combination in blade as well as petioles. Narrow K: Na ratio in Dogridge, Salt Creek and own rooted vines indicated relative Na accumulation.

Chloride : All the rootstocks were effective in restricting chloride concentration in vine parts compared to own rooted vines. Lowest chloride concentration in blade (0.193%) as well as petioles (0.622%) was observed in vines grafted on B2-56. In case of own rooted vines toxic concentration of chloride (1.603%) was present in petioles whereas in rootstocks it ranged from 0.622 to 1.214 per cent. Among the rootstocks 1613C was least efficient in restricting the chloride content in petioles. Further, the chloride content in leaf blades was not high enough to cause leaf necrosis.

Magnesium : No significant differences were observed in petiole Mg concentration among Dogridge, Salt Creek and B2-56 rootstock. Magnesium concentration in leaf blades was significantly higher in B2-56 than Dogridge rootstock.

Calcium : In petioles significantly lower Ca concentration was observed in B2-56 rootstock which was statistically on par with Salt Creek and Dogridge. Vines on 1613C had significantly higher Ca content in petioles. Salt Creek had significantly higher Ca concentration in blades than B2-56.

To conclude, the leaf necrosis and blackening was associated with low potassium content and high Na content in the vine tissues. Higher Na concentration in petioles of Thompson Seedless vines grafted on Dogridge rootstock compared to own rooted were also corroborated by our earlier studies. B2-56 rootstock was most efficient in K uptake under saline irrigation and low potassium content was associated with the leaf blackening and necrosis. The vines raised on Dogridge, Salt Creek and own rooted did not prevent accumulation of Na due to low K content in the vine tissues. Dogridge and Salt Creek were more prone to leaf blackening and necrosis due to their failure to maintain

higher K:Na ratio in the blade and petioles in Thompson Seedless vines. Chloride content was not associated with the leaf blackening and necrosis as toxic accumulation was not found in vine tissues. Thus it can be concluded that Thompson Seedless vines raised on B2-56 and 1613C rootstocks could maintain higher K:Na ratio and tolerated the saline irrigation better than remaining scion stock combinations.

7.2 Salinity tolerance of Thompson seedless vines grafted on different rootstocks

Salinity has become a menace for grape industry in Maharashtra. Primarily, it is due to poor quality irrigation water that has high electrical conductivity (EC) coupled with chloride and sodium ions in many instances. This profoundly affects the productivity and sustainability of the vineyards. Under such situations, raising vines on the rootstocks can safeguard them against the adverse effects of salinity. An experiment was, therefore, conducted to study the effect of different salinity levels 2 EC and 4 EC in Thompson Seedless vines raised on four different rootstocks viz. Dogridge, 110R, 1103P and St. George and on own root to study the changes in nutrient concentration in the vines. The irrigation water used had 1.99 EC and sodium chloride was used to further manipulate water to attain the desired salinity level for experiment. The treatments on salinity were imposed in the fruit pruning season from the shoot growth stage (30 days after pruning). The petiole and leaf samples were collected at harvest and analysed for their nutrient content.

The result indicated that Thompson Seedless vines raised on 110R and 1103P rootstocks did not show the marginal necrosis and leaf blackening symptoms even at 4 EC level also, whereas other rootstocks showed mild to severe symptoms at both the salinity levels. In fact, Salinity-rootstock interaction was prominent with respect to the sodium (Na), potassium (K), Chloride (Cl) and phosphorus (P) contents in the petiole and leaf blade. Significant differences existed between rootstocks and own root at both the EC level with the lowest mean petiole Na values recorded in case of vines raised on 110R. In the leaf blade, the Na content increased from 0.623 per cent at 2 EC to 1.023 per cent at 4 EC level in case of Dogridge, clearly implying that Dogridge rootstock cannot be used in situations, where Na content is high in irrigation water (Fig. 11a). However, the Na accumulation though significant in vines raised on 110R between both the levels was least as compared to other rootstocks, implying that at higher Na level in the irrigation water, this rootstock could be preferred over Dogridge, prevalent rootstock in the Indian vineyards. In case of Cl content in both leaf blade and petiole, all the rootstocks proved to be better excluders in comparison to the own rooted vines. The Cl values in the petiole and leaf blade, for all the rootstocks ranged from 0.767 - 0.871 per cent and 0.15-0.20 per cent at 2EC to 0.927 - 1.338 per cent and 0.26 - 0.41 per cent at 4 EC level respectively, whereas, in case of own rooted vines, it increased from 1.626 per cent and 0.696 per cent at 2 EC to 2.07 per cent and 1.49 per cent at 4 EC respectively (Fig. 11b). Higher K values (>1 %) in the petiole was recorded in vines raised on 110R at both the salinity levels whereas it declined from 0.772 per cent in vines raised on Dogridge at 2 EC to 0.433 per cent at 4 EC level. In fact at 4 EC, no significant differences was observed in vines raised on St. George, Own root and Dogridge. The vines raised on 110R and 1103P, maintained K levels at both the salinity levels in leaf blade. Highest P content in both the petioles and leaf blade was obtained in own rooted vines followed by vines raised on 110R and 1103P.

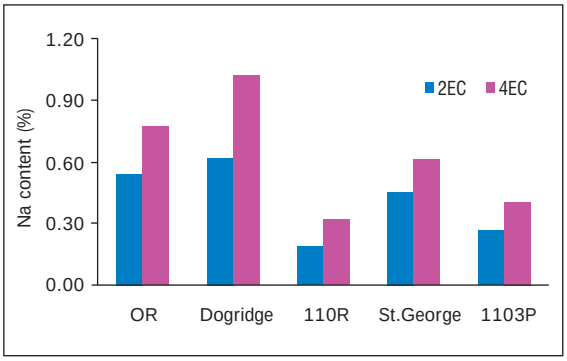


Fig 11a. Leaf blade sodium content in Thompson Seedless vines raised on rootstocks.

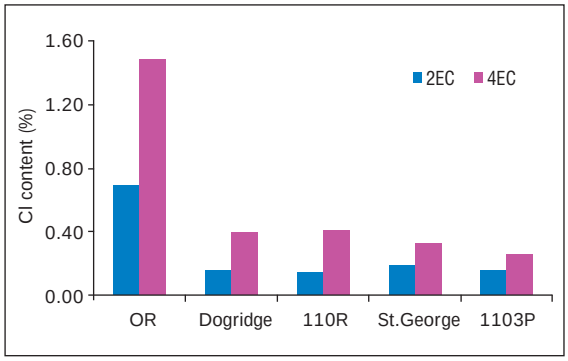


Fig 11b. Leaf blade chloride content in Thompson Seedless vines raised on rootstocks

Programme 9. Grape physiology including use of bioregulators

9.1 Studies on pink berry in white grapes and its management

Cell Suspension Culture

Callus formation was tried from tender leaves, petioles, tendrils, berries and berry skin. Callus was formed from petioles, tendrils. In another trial callus formation was tried from berry skins of Thompson Seedless (green and pink berries) and Sharad Seedless by manipulating the MS media with different concentrations of NAA, 2,4-D and TDZ. The experiments are in progress.

Effect of paper cover bags on incidence of pink berry formation

Different types of paper bags were used to cover the bunches to minimise the appearance of pink berries. The treatments details and results are given in table 14. Pink berry disorder was observed in bunches which were covered fully after 75 days after pruning also. No treatments could prevent appearance of pink berry in grapes particularly during this year.

9.2 Management of other physiological disorder

A new physiological disorder, swelling of knot was observed in Sharad Seedless and Thompson Seedless varieties in Golegaon of Junnar district, Walwa of Sangli district and some parts in Indapur of Pune district and Niphad of Nasik district.

9.3 Standardization of bioregulators schedule for improving quality and yield of table and wine grapes

9.3.1 Standardization of bioregulators protocol for Manjri Naveen, a newly released grape variety

Different combination of CPPU, 6BA and GA_3 were used to standardize the optimal dose of bioregulators for Manjri Naveen. The data on bioregulators showed the significant differences in bunch weight, berry size, acidity and shelf life. Among the treatments, application of 6BA @ 20 ppm

Table 14. Appearance of pink berry in bunch and Anthocyanin content in affected berry's skin

Treatments	Paper cover	Pink berries / bunch (%)			Anthocyanin (mg/g FW)		
		75 days	85 days	95 days	75 days	85 days	95 days
T1	Tyvek (Closed)	10.0	16.5	3.8	0.003	0.002	0.003
T2	Tyvek (open)	12.4	4.8	15.1	0.001	0.002	0.004
T3	News paper	6.1	20.4	12.8	0.003	0.002	0.004
T4	Brown paper	5.4	23.7	6.7	0.001	0.001	0.003
T5	No cover (open bunches)	32.0	32.0	32.0	0.003	0.003	0.003

and GA_3 @20 ppm showed the best results with respect to above parameters (Table 15 and 16). The experiment will be continued for two more years.

Table 15. Effect of bioregulators on bunch and berry characters in Manjri Naveen variety of grapes

Treatments Dose (ppm)			50 Berry weight (g)	Pedicel thickness (mm)	Berry diameter (mm)	Berry length (mm)	TSS (°B)	Acidity (%)
	CPPU/6BA	GA_3						
T1	0.25 ppm CPPU	20	153 ± 35.36	3.18 ± 0.05^{ab}	16.25 ± 0.35^{ab}	22.50 ± 0.85^{bcd}	15.40 ± 0.00^{a}	0.71 ± 0.71^{c}
T2	0.25 ppm CPPU	30	175 ± 51.62	3.83 ± 0.27^{a}	16.80 ± 0.57^{ab}	24.87 ± 0.66^{ab}	16.15 ± 0.21^{a}	0.78 ± 0.71^{c}
T3	0. 50 ppm CPPU	20	167 ± 31.11	2.74 ± 0.52^{ab}	16.27 ± 0.04^{ab}	20.93 ± 2.22^{cde}	14.95 ± 0.92^{a}	0.97 ± 4.24^{b}
T4	0. 50 ppm CPPU	30	119 ± 14.85^{b}	2.70 ± 0.42^{ab}	14.23 ± 0.04^{b}	19.67 ± 0.81^{e}	16.00 ± 0.57^{a}	0.78 ± 1.63^{c}
T5	1.0 ppm CPPU	20	138 ± 3.54^{ab}	3.36 ± 0.28^{ab}	15.58 ± 1.10^{ab}	20.57 ± 1.74^{de}	14.85 ± 0.49^{a}	0.79 ± 1.70^{c}
T6	1.0 ppm CPPU	30	110 ± 26.87^{b}	2.44 ± 0.13^{b}	14.31 ± 2.98^{b}	19.07 ± 0.24^{e}	15.14 ± 0.66^{a}	0.77 ± 0.28^{c}
T7	10 ppm 6BA	20	208 ± 22.63^{a}	3.25 ± 0.26^{ab}	16.41 ± 0.13^{ab}	26.04 ± 0.52^{a}	14.90 ± 0.42^{a}	0.90 ± 0.85^{c}
T8	10 ppm 6BA	30	171 ± 41.01^{ab}	2.86 ± 1.05^{ab}	16.37 ± 0.04^{ab}	23.97 ± 0.23^{ab}	15.40 ± 0.00^{a}	0.78 ± 1.84^{c}
T9	20 ppm 6BA	20	208 ± 62.23^{a}	3.80 ± 0.14^{a}	17.55 ± 1.06^{a}	25.82 ± 0.96^{a}	15.90 ± 0.42^{a}	0.78 ± 0.92^{c}
T10	20 ppm 6BA	30	189 ± 2.83^{ab}	3.03 ± 0.84^{ab}	14.55 ± 1.91^{b}	23.13 ± 0.46^{bc}	17.85 ± 2.05^{a}	1.10 ± 4.90^{a}
T11	Control		146 ± 7.78^{ab}	2.72 ± 0.23^{ab}	14.35 ± 0.35^{b}	22.78 ± 0.96^{bcd}	15.62 ± 4.55^{a}	1.50 ± 0.79^{a}

Letters indicate the treatment wise significant difference. Tretments followed by the same letter are not significantly different at $P \leq 0.05$

Table 16. Effect of bioregulators on shelf life in Manjri Naveen

Treat-ments	Physiological loss in weight					
	1 day	2 day	3 day	4 day	5 day	6 day
T1	3.67±0.05^{c}	6.25±0.18^{efg}	9.20±0.02^{de}	13.08±0.64^{ab}	15.26±1.05^{cd}	17.31±1.29^{de}
T2	3.45±0.08^{c}	6.67±0.67^{efg}	9.64±0.36^{de}	14.24±0.57^{ab}	18.04±1.82^{bc}	18.84±0.83^{cd}
T3	4.66±0.67^{abc}	7.52±0.40^{ef}	10.74±0.18^{c}	17.09±0.93^{ab}	18.57±1.60^{bc}	22.68±2.05^{b}
T4	6.52±0.05^{a}	9.93±1.10^{c}	14.37±0.01^{a}	17.70±3.66^{a}	21.17±2.57^{ab}	25.53±1.54^{a}
T5	4.07±0.37^{bc}	8.05±0.15^{de}	10.70±0.35^{c}	13.86±0.02^{ab}	17.90±0.75^{bc}	21.46±0.01^{bc}
T6	5.00±1.09^{abc}	10.19±0.13	12.50±0.34^{b}	17.07±0.10^{ab}	18.87±0.90^{bc}	21.51±1.91^{bc}
T7	4.74±0.80^{abc}	11.68±0.81^{b}	11.78±0.95^{bc}	16.84±2.20^{ab}	18.72±1.63^{bc}	20.56±0.29^{bc}
T8	4.87±2.31^{abc}	13.38±0.52^{a}	14.61±0.53^{a}	16.83±0.69^{ab}	23.26±1.85^{a}	25.30±0.89^{a}
T9	3.02±0.61^{c}	5.81±0.52^{g}	8.28±0.53^{e}	11.94±2.30^{b}	13.00±0.21^{d}	15.79±0.93^{e}
T10	3.69±0.77^{bc}	7.95±1.14^{e}	9.62±0.35^{de}	16.20±5.22^{ab}	15.48±0.07^{cd}	18.98±1.10^{cd}
T11	5.91±0.65^{ab}	9.46±0.52^{cd}	11.10±0.60^{c}	18.00±0.50^{a}	20.23±1.70^{ab}	22.38±0.11^{b}

9.3.2 Multiresidue method for the plant growth regulators in grapes

Multiresidue method for the plant growth regulators was standardized and around 14 bioregulators were analysed with this method. The bioregulators studied were Abscisic acid, CCC, Daminozide, GA_3, IBA, IAA, Kinetin, CPPU, NAA, Zeatin, 2-4-D, 6-BA, Isoprothialane and Paclubutrazole.

9.5 New chemicals/ botanicals for improving bud break and grape quality

9.5.1 Bio efficacy of Ethephon (39 % S.L.) for leaf fall and its subsequent effect on fruiting and yield in grapes

Ethephon is a plant growth regulator used as a leaf defoliator in grapes. To see its efficacy as a leaf defoliator, different doses viz. 1.5, 2.0, 2.5, 3.0 ml/l at single dose and at 2.5 ml/l in two doses were used on Thompson Seedless vines.

The significant differences were recorded with the applications of Ethephon 39 SL with respect to leaf fall, berry diameter, TSS and acidity. The maximum leaf fall occurred when the Ethephon 39% SL was used @ 2.5ml twice at 10 and 12 days before pruning. However applications of Ethephon 39% SL @ 3.0 ml was also at par with this treatment. The influence of Ethephon was recorded for berry diameter and the maximum berry diameter was observed in T4 treatment as compared to any other treatment. The similar trend was found in TSS and acidity.

The significant differences were recorded during 7 days of storage of grapes up to 3rd days in all the treatments. The least physiological loss in weight (PLW) was recorded in T2 treatment during 1st, 2nd and 3rd days. From 4th day onwards no significant differences were observed.

9.5.2 Bio efficacy of Progibb 40% WSG in grapes

Gibberellic acid in powder form with 40% active ingredient was applied on the grapes from prebloom to 6-7 mm berry size stage in variable doses (10, 20, 30, 40 and 50 ppm) along with GA_3 technical grade, tricontanol 0.05% EC and compared with untreated control.

Significant differences were recorded in mean bunch weight, berry weight, berry size, pedicel thickness, berry crispness, berry thickness, quality and yield parameters. In general, the mean bunch weight was recorded more in GA_3 treatments (195-300 g) as compared to the untreated control (148 g). The treatment of Progibb 40% @ 50 ppm recorded the highest bunch weight (300 g). The berry diameter was significantly higher in this treatment (16.33 mm) followed by tricontanol treatment compared to other treatments. Pedicel thickness was more in all the GA_3 treatments as compared to untreated control.

9.5.3 To evaluate bio-efficacy and standardization of dose of 90% GA_3 in grapes

GA_3 (China make) contains powder of 90% Gibberellic acid and is used to increase the berry size and quality of grapes. The trial was sponsored by M/s Gargi packing Industries Nasik, India. The formulation was used at a concentration of 10, 20, 30, 40 and 50 ppm.

The data on bunch, berry, quality and yield parameters were recorded. Among these parameters the significant differences were recorded in mean bunch weight, berry size, quality and yield. In general, the mean bunch weight was more in GA_3 treatments (245 - 324 g) as compared to the untreated control (148 g). The treatments of GA_3 were on par with each other but higher than the untreated control with respect to 50 berry weight. The berry size was also higher in GA_3 treated berries (15.1 - 15.6 mm) as compared to control (13 mm). However, the TSS in control was higher than treated bunches. Yield per vine was recorded significantly higher in GA_3 treatments and these treatments were on par with each other.

9.5.4 Bioefficay and phytotoxicity evaluation of herbicide BCS AA 10717 SC 500 against complex weed flora in grapes

A field trial was conducted to evaluate the bio efficacy of BCS AA 10717 SC 500 for weed control in Thompson Seedless grapes grafted on Dogridge rootstock at the farm of NRC for Grapes. Bayer Crop Science Limited sponsored the trial. The treatment details are listed in table 17.

All the treatments of herbicide and manual weeding showed reduction in the total number of weeds recorded at the 15, 30 and 45 days after application as against control plot.

The manually weeded plot showed significant weed control (0.0, 0.0) per m^2 at 15, 30 and 45 days after application of BCS AA 10717 SC 500. The treatment of Atrazine 50 WP also showed 100% weed control after 15 and 30 days of application. The treatment with Diuron 80 WP @ 2000 g a.i/ha (0.5,6.5) recorded minimum number of weeds at 15, 30 and 45 days after application and it was found more effective. At 15 days after application, the treatment of BCS AA 10717 SC 500 @ 37.5 g a.i/ha (2.0) and the treatment of BCS AA 10717 SC 500 @ 50 g a.i/ha (2.0) were on par with the treatment of BCS AA 10717 SC 500 @ 25 g a.i/ha (5.5) suggesting that, active substance concentration (g a.i/ ha) and weed density (no./m^2) were proportional. The treatment of BCS AA

Table 17. Treatment details of BCS AA 10717 SC 500

Treatments	Herbicide formulation	Active substance dose a.i/ha (ml)	Total Product dose (ml/ha)	Time of application at weed stage
T1	Untreated control	-	-	2-3 leaf
T2	BCS AA 10717 SC 500	25	50	2-3 leaf
T3	BCS AA 10717 SC 500	37.5	75	2-3 leaf
T4	BCS AA 10717 SC 500	50	100	2-3 leaf
T5	Diuron 80 WP	2000	2500	2-3 leaf
T6	Atrazine 50 WP	1250	2500	2-3 leaf
T7	Hand Weeded Check	-	-	15, 30 and 45 days after pruning

10717 SC 500 @ 37.5 g a.i/ha (17.0) was found on par with the treatment of Atrazine 50 WP @ 1250 g a.i/ha (16.0) at 45 days after application.

Phytotoxicity

No phytotoxic signs or symptoms viz. leaf tip/surface injury, wilting, vein clearing, necrosis, epinasty and/or hyponasty were observed up to 30 days after treatment with all the test herbicides.

Yield

All the treatments recorded significantly higher yield in comparison to untreated weedy check. The maximum yield (27.6 T/ha) was obtained with the three manual weeding followed by treatment of BCS AA 10717 SC 500 @ 50 g a.i/ ha (25.4 T/ha) and BCS AA 10717 SC 500 @ 37.5 g a.i./ha (25.3 T/ha).

9.5.5 Bioefficacy and phytotoxicity evaluation of UPH 707 against complex weed flora in grapes

The experiment was laid out in a randomised block design with six treatments replicated four times. The treatments included test chemical UPH-707 at 250, 500 and 750 g a.i./ha dosages along with standard check of Paraquate dichloride at 500 g a.i./ha. These were compared with weedy check and manually weeded check. The treatments were applied as post emergence directed inter-row spray at 2-3 leaf stage (22 days after pruning) of weeds in the vineyard.

Bio-efficacy

All the treatments significantly reduced the total number of weeds recorded at 15 and 30 days after treatment over untreated weedy check. The manually weeded plot recorded the minimum number of weeds per sq m (3.5, 4.5) and followed by the treatment of UPH 707 @ 750 g a.i. /ha (41.5, 29.0), which was found at par with the treatment of UPH 707 at 500 g a.i./ha (48.5, 44.0) and was more effective than standard check of Paraquat dichloride @ 500 g.a.i./ha (89.5, 89.0).

The observation recorded on dry weight of weeds at 15 and 30 days after treatment recorded minimum biomass weights per m^2 (6.1g, 6.5g) with the two manual weeding executed twice at 15 and 30 days after pruning and followed by the application of UPH 707 @ 750 g a.i./ha (18.3g, 25.8g). The treatment of UPH 707 @ 750 g a.i./ha was on par with treatment of UPH 707 @ 500 g a.i./ha (25.0g, 34.1g) and both the treatments proved more effective than Paraquate dichloride @ 500 g.a.i./ha (45.6g, 54.2g).

Phytotoxicity

No phytotoxic signs or symptoms viz. leaf tip/surface injury, wilting, vein clearing, necrosis, epinasty and/or hyponasty were observed at 1, 3, 7 and 15 days after treatment with test herbicide (UPH - 707) at all the dosages including the higher dose of UPH 707@1000 g a.i./ha.

Yield

All the treatments recorded significantly higher berry yield in comparison to untreated weedy check. The maximum yield (26.3 T/ha) was obtained with the two manual weeding executed twice at 15 and 30 days after pruning. The next higher yield was recorded with treatment UPH 707 @ 750 g a.i./ha (24.7 T/ha) which was however on par with the treatment of UPH 707 @ 500 g a.i./ha (23.6 T/ha) and both the treatments proved more effective than the treatment of Paraquat dichloride 24 % SL @ 500 g a.i./ha (20.7 T/ha). Yield was significantly lower in weedy check (14.3 T/ha) as compared to all other treatments.

9.5.6 Bioefficay and phytotoxicity evaluation of PC 02-08 against complex weed flora in grapes

A field experiment was conducted to evaluate the bioefficacy of PC 02-08 against the complex weed flora in grapes. The experiment was laid out in a randomised block design with nine treatments replicated three times. The treatments included test chemical PC 02-08 at 600, 800, 1000, 1200, 1600 and 800+500 g a.i./ha dosages along with standard check of Glyphosate. These were compared with weedy check and manually weeded check. The treatments were applied as post emergence directed inter-row spray at 2-3 leaf stage (22 days after pruning) of weeds in the vineyard.

Bioefficacy

All the treatments significantly reduced the total number of weeds recorded at 15, 30 and 60 days after treatment over untreated weedy check. The treatment PC 02-08 66 SL + 2,4 D Na 80%@ 800+500 g a.i./ha recorded the minimum number of weeds per m^2 (25.9) followed by the manually weeded plot (26.6), at 15 days after application.

The treatment PC 02-08 66 SL @ 800 g a.i./ha recorded the minimum number of weeds per m^2 (44.9) followed by the treatment PC 02-08 66 SL@ 600 g a.i./ha (59.1), at 30 days after application. The treatment of PC 02-08 66 SL @ 1000 g a.i./ha was on par with the treatment of PC 02-08 66 SL + 2, 4 D Na 80%@ 800+500 g a.i./ha at 30 days after application.

The treatment PC 02-08 66 SL + 2,4 D Na 80%@ 800+500 g a.i./ha recorded the minimum number of weeds per m^2 (24.9) followed by the treatment PC 02-08 66 SL @ 1000 g a.i./ha (28.8) at 60 days after application. The treatment of PC 02-08 66 SL @ 1200 g a.i./ha (52.3) was on par with treatment of PC 02-08 66 SL@ 800 g a.i./ha (58.8) at 60 days after application.

The observation recorded on dry weight of weeds 15 days after treatment recorded minimum biomass weights per m^2 (31.1 g) with the two manual weeding executed twice at 15 days after pruning and followed by the application of PC 02-08 66 SL + 2, 4 D Na 80%@ 800+500 g a.i./ha (35.4 g). The manually weeded plot recorded minimum biomass weights per m^2 (39.9 g) and was on par with treatment of PC 02-08 66 SL@ 800 g a.i./ha (41.7g) at 30 days after application. The manually weeded plot recorded minimum biomass weights per m^2 (34.8 g) and was on par with treatment of PC 02-08 66 SL@ 1000 g a.i./ha (38.5g) at 60 days after application.

Phytotoxicity

No phytotoxic signs or symptoms viz. leaf tip/surface injury, wilting, vein clearing, necrosis, epinasty and/or hyponasty were observed at 1, 3, 5,7 ,10, 15 and 30 days after treatment with test herbicide (PC 02-08) at all the dosages including the higher dose of PC 02-08 66 SL@ 1600 g a.i./ha.

Yield

All the treatments recorded significantly higher yield in comparison to untreated weedy check. The maximum yield (19.3 T/ha) was obtained with the two manual weeding executed twice at 15,30 and 60 days after pruning. The next higher yield was recorded with treatment PC 02-08 66 SL@ 1200 g a.i./ha (18.8 T/ha) which was on par with the treatment of PC 02-08 66 SL@ 800 g a.i./ha (16.2 T/ha) and both the treatments proved more effective than the treatment of Glyphosate (16.2 T/ha). Yield was significantly lower in weedy check (9.9 T/ha) compared to all other treatments.

Programme 11. Integrated disease management in grapes

11.1 Weather data and weather forecast based disease management

Data on weather and disease incidence from Khedgaon and Palkhed of Nasik district, Kasegaon of Pandharpur district, and Palus and Valva of Sangli district was collected during fruiting season of 2008-09. The data was used for estimation of risk of powdery mildew, downy mildew and Anthracnose. The estimated disease risk, location specific weather forecast for major grape growing areas and suitable advice for disease management for seven days was placed on the Institute's website. This web page is updated at weekly interval. This web page received overwhelming response from growers and has been visited 7000 times within 8 months. Based on last four years data, the following parameters are used for the estimation of downy mildew risk.

Primary cycle

- starts (first time after harvest, when downy mildew become active) during June - July (rarely early, exception during May 2008 in Sangli region)
- if at least 2 major rains (> 10 mm) in the area within a weeks time and maximum temperature is < 30 °C immediately after rain.

Secondary cycle and spread of diseases

- can occur any time after primary cycle starts, favoured by night temperature of 12-20 °C and RH > 95%, morning leaf wetness at least 2.5 hours after 6.0 am or 4.0 mm rain during day time.

- High risk of disease when new shoots present during August–October (before fruit pruning) and from 12 to 55 days after fruit pruning. Medium risk after 55 to 75 days after fruit pruning.

Spray applications are needed only after primary cycle start is declared and conditions for secondary spread are fulfilled.

11.2 Bio-efficacy of fungicides for management of diseases

11.2.1 Multilocational trial on downy mildew

Several new fungicides (Table 18) were tested for their bio-efficacy in control of downy mildew in multilocational trials at Valva (Dist. Sangli), Golegaon (Junnar, Dist. Pune), Kasegaon (Pandharpur, Dist. Solapur) and NRC Grapes, Manjri (Pune).

Table 18. New fungicides and their effective dose for the management fo downy mildew

Sr. No.	Fungicide	Optimum dose (per litre)
1.	Profiler 71.14 WDG (Iprovalicarp + Fosetyl al)	2.25 g
2.	Acanto 25SC (Picoxystrobin 25%)	0.3 ml
3.	Metominostrobin 20SC	0.75 ml
4.	(Zineb + Hexaconazole) 72WP	2.0 g
5.	CIL/F108 (Dimethomorph 50 %)	1.0 g
6.	Dimethomorph + Coded product (BASF- 651)	0.8 g
7.	Areofungin Sol	2.5 g

Based on weather conditions, six to nine sprays at above mentioned doses were required for effective control of the downy mildew. The sprays were given from 15th to 60th day after forward pruning at different locations. The residue of the fungicide in bunches at harvest was estimated at optimum dose and 2x dose. None of the sample showed residue above MRL. Thus all the above fungicides are considered safe.

During 2008-09 fruiting season, grape growing regions received rains followed by warm conditions (Min. temperatures above 15°C) during last week of November and first week of December. These conditions provided ideal conditions for the development of downy mildew and late stages bunches were damaged due to downy mildew, requiring late stage application of fungicides. Normal recommended practice i.e. spray of fungicides was not appropriate due to their compact nature as fungicides do not reach inside the wet portions of bunches. Dipping of individual bunches in fungicide solutions was the only alternative under such adverse conditions. Most of the fungicides recommended for downy mildew have PHI more than 60 days and therefore, not advised for late stage application. In such situation Azoxystrobin 25 SC with PHI of 7 days and MRL 2.0 ppm, therefore had distinct advantage. The 7 day PHI is based on spray applications and not on dipping. To confirm the PHI for dipping applications, samples from various vineyards receiving different

treatments of Azoxystrobin were used and pesticide residues were estimated. The variety, type of treatments and residue at harvest are given in Table 19. The results indicated that even when four treatments including two dippings and two sprays were given and the last treatment was 114 days after pruning, the residue at harvest was below MRL. The residue at harvest in different treatment varied between 0.04 to 1.81 ppm which is below the MRL of 2.0 ppm. Therefore, late applications of azoxystrobin 25SC could be considered as safe for the management of downy mildew.

Table 19. Residue of Azoxystrobin 25SC at harvest, applied as spray and bunch dip at late stage of bunch development

Sl. No.	Variety	Method of application (Azoxystrobin 25SC at 0.5 ml/l)	Time of application (DAP*)	Harvest (DAP)	Residue detected at harvest (ppm)
1.	Thompson Seedless	Spray	45	136	0.06
		Spray	58		
2.	Thompson Seedless	Spray	32	130	1.65
		Bunch dip	86		
		Spray	114		
3.	Thompson Seedless	Spray	27	125	1.81
		Bunch dip	59		
		Bunch dip	84		
		Spray	114		
4.	Tas-A-Ganesh	Bunch dip	69	135	1.60
5.	Tas-A-Ganesh	Bunch dip (Alongwith GA and CPPU)	56	135	0.15
6.	Tas-A-Ganesh	Spray	44	137	0.23
		Bunch dip	75		
		Spray	90		
7.	2A Clone	Spray	55	140	0.11
8.	2A Clone	Bunch dip (Along with GA)	46	135	0.08
9.	2A Clone	Bunch dip (Along with GA and CPPU)	64	135	0.80
10.	2A Clone	Bunch dip (Along with GA and CPPU)	52	135	0.04
11.	Sonaka	Bunch dip (Along with GA and CPPU)	50	140	0.10
12.	Sonaka	Spray	17	137	0.31
		Bunch dip	69		
		Spray	114		
13.	Fantasy Seedless	Spray	50	—	0.81
		Bunch dip (1ml/l)	90		

DAP : Days after pruning

11.2.2 Bio-efficacy trials on downy mildew and anthracnose during April-October 2008

The following fungicides were tested on vegetative growth after backward pruning (April-October) and were found to be suitable for the control of downy mildew and anthracnose at their doses given in table 20.

Table 20. Effective dose of fungicides for the management of downy mildew and anthracnose

Sl. No.	Fungicide	Diseases controlled	Optimum dose (per litre)
1.	Cuprous Oxide 75WG	Downy mildew and anthracnose	1.5 g
2.	Roko 70WP (Thiophanate methyl 70WP)	Anthracnose	0.715 g

11.2.3 Bio-efficacy trial on powdery mildew

The following fungicide were tested for the control of powdery mildew during fruiting season 2008 - 09 and were found effective at doses given in table 21.

Table 21. Optimum doses of new fungicides for the control of powdery mildew

Sl. No.	Fungicide	Optimum dose (per litre)
1.	Fluopyrum + Tebuconazole 400SC	0.469 ml
2.	Sporekiller	2.0 g
3.	Milastin K (*Basillus subtilis*)	1 to 2 g
4.	Areofungin Sol	2.5 g
5.	Trifumizole 480SC	0.423 ml

11.3 Study on the biology of grape anthracnose

Sixty anthracnose lesions formed on shoots during 2007-08 season were physically examined. The average lesion length, width and depth was 6.85 ± 3.49 mm, 4.68 ± 1.58 mm and 1.02 ± 0.74 mm respectively. Lesions were either raised or sunken in the middle. Sclerotia, the main survival structures, were not observed on any of the lesions. The pathogen could be isolated from 15 per cent of the lesions, indicating high rate of survival despite the vineyard receiving regular scheduled fungicide sprays. 13.33 per cent isolations were from raised lesions and 1.67 per cent isolations were from sunken lesions. The isolates were purified by making single spore cultures. The colonies were initially white with orange acervuli, later turned greyish. Setae were not present. Spores were hyaline, cylindrical, slightly depressed in the center, and about 11.9 x 4.6µ in size. Cultures are being maintained for characterization and variability studies.

11.4 Studies on Grape Viruses

11.4.1 Survey of vineyards for grape viruses in India

In different surveys so far plants have been found positive to Grape leaf roll virus (GLRaV) strains 1, 2, 3, 5, and Grapevine Fleck Virus (GFkV). GLRaV 1 and 3 are most commonly present in table grapes (Sharad Seedless, and Thompson Seedless and its clones) as well as wine grapes in Chardhonnay, Sauvignon Blanc, Pinot Noir, Cabernet Sauvignon, Merlot and Shiraz. In one of the symptomatic vineyards of Cabernet Sauvignon at Niphad, more than 85% vines were showing typical GLRaV symptoms on leaves in March 2009. In normal conditions, symptom expression takes place after January. However, severe water stress apparently had increased the expression of symptoms. Due to lack of chlorophyll in leaves of affected vines the TSS of mature berries did not increase beyond 18% as against above 20% in healthy looking plants.

Fig. 12. Healthy (right) and GLRaV- 3 infected vines at vineyard near Niphad

Programme 12. Integrated insect and mite pest management in grapes

12.1 Seasonal incidence of insect pests in grape vineyards and their correlation with weather-parameters

Mealybug population buildup was found to be coincided with increase in temperature, decrease in the humidity and advancement in the berry development. Thrips population was negatively correlated with minimum temperature (r = –0.72) and rain fall (r = –0.43). Results also indicated that the mite population increased from 4.20/leaf in December to 24.20 mites/leaf in February under Pune conditions and it was negatively correlated with minimum temperature (r = –0.48) and relative humidity (r = –0.65).

12.2 Survey for incidence of insect pests and their natural enemies in important grape growing areas

Moderate incidence of thrips and mealybugs was observed in 2008-09 in major grape growing areas of Maharashtra. Sporadic incidence of stem borer was also noticed around Sangli and Nasik region of Maharashtra. An increase in Jassids (Hoppers) incidence was observed in the months of November and December especially in the vineyards of the institute.

Fig. 13. Stem borer grub

Fig. 14. Stem borer adult

Fig. 15. Stem borer damage

Fig. 16. Trunk damaged by stem borer

Fig. 16. Injection of chemical into the bore hole

Five mealybug species viz., *Maconellicoccus hirsutus*, *Planococcus citri*, *Nipaecoccus viridis*, *Pseudococcus longispinus* and *Ferrisia virgata* were collected. Among them, *M. hirsutus* and *P. citri* were found to cause severe loss. Eight species of ants viz., *Componotus compressus*, *Componotus sericus*, *C. rufuglaucus*, *Tapinoma melanocephalum*, *Monomorium sp.*, *Techinomyrmix sp.*, *Solenopsis geminata* and *Dolichoderus affinis* were found associated with the mealybugs in the vineyards. The green lacewing *Chrysoperla carnea* was also commonly found in many of the vineyards as a predator of the mealybugs.

Two species of thrips viz., *Scirtothrips dorsalis* and *Haplothrips hawaiensis* were found

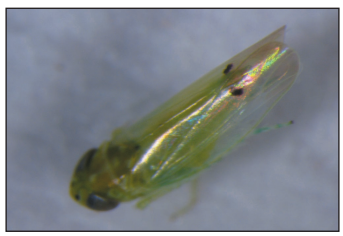


Fig. 18. Jassid (hopper)

Fig. 19. Hopper shoot damage

attacking the grapes in Maharashtra. The mite causing the damage to grapes was identified as red spider mite *Tetranychus urticae*. More than 50 per cent of the leaves were found infested with mites at Nasik Division. The incidence of mite was also noticed in other parts of Maharashtra. Stem borer was found causing damage in and around Sangli and Nasik region and it was identified as *Coelosterna scabrator* (Fig. 13 to 17). Jassids (Hopper) found causing damage in NRC for Grapes campus and it was identified as *Arboridia vinifera* (Fig. 18 and 19).

12.3 Different indigenous methods and insecticides used for management of insects in grapes

Different cultural and mechanical methods followed by grape growers for the management of mealy bugs and other insects were recorded. For the management of mealy bugs, removal of loose bark and applying sticky bands are the common practices followed by grape growers. A few growers also use spray of green chilli and garlic extract (5:1 ratio) for mealy bug management. Several growers were found to spray herbal preparation made out of tobacco, Parthenium, *Vitex negundo*, *Lantana camara* and Dasha Parna (preparation made out of ten herbs). For the management of thrips, 10 per cent Gomutra (cow's urine) is also commonly used by few farmers.

12.4 Evaluation and utilization of parasites and predators

In a Flame Seedless garden of MRDBS adjacent to institute's research farm, a total of 2000 larvae of *Cryptolaemus montrouzieri* were released in one hectare area in August–September 2008 and repeated in the last week of December 2008. A mean of 10 per cent bunch infestation was observed in January 2009 in the *Cryptolaemus* released plot as against 50 per cent bunch infestation in January 2008 in the unreleased plot.

12.5 Evaluation and utilization of different botanicals

During 2008-09, different botanicals were tested for their efficacy against different insect pests. The details of these botanical and their effective dose and target pests are listed in Table 22.

Table 22. Different botanicals tested for various insect pests in grapes

Sl. No.	Name	Major ingredients in formulation	Target insect pests	Dose (ml/l)
1	Acute Plus	*Andropogon nandrus*, *Ocimum sanctum*, *Farnesol* and dissolving agent	Mites	100
2	New Tech	*Andropogon nandrus*, *Ocimum sanctum*, *Annona reticulate* with microbial enzymes, dissolving agent	Mealybugs	2.5
3	TERI-DBT Bollcure	Plant extract of *Eucalyptus*	Thrips and Mealybugs	5.5
4	Bio-303	*Sophora flavascens*, *Pterocarya stenoptera*, *Platycladus orientalis*, *Melia azedarach*	Thrips and Mites	1.0

12.7 Toxicity test of new generation insecticides on Australian ladybird beetle *Cryptolaemus montrouzieri*

Several new generation insecticides like spinosad, buprofezin, methomyl, imidacloprid, thiamethoxam, clothianidin, fipronil, chlorpyriphos, cartap hydrochloride and dichlorvos were tested for their toxicity under laboratory conditions. All these insecticides were found to be safe to beetle and therefore can be integrated in the IPM.

12.8 Bioefficay of new chemicals for the control of insect pests

Several new generation insecticides viz. Spirotetramate, CHA-5425, Fipronil 80% WG (Regent 80% WG), Abamectin 1.9% EC (Vertimec) were tested on insect pests like mealybugs, mites and thrips. The details of these insecticides and their effective dose are given in table 23. The PHI and MRL were also determined for these chemicals. Based on the results these chemicals were included in recommendation schedule of the centre for both domestic and export market of grapes.

Table 23. Details of new generation insecticides tested for the control of insect pests

Sl. No.	Target pest	Insecticide used	Brand name	Strength	Dose/litre of water
1.	Mealybugs and mites	Spirotetramat	-	150 OD	0.5 ml/l
2.	Thrips	CHA-5425	-	-	0.5 ml/l
3.	Thrips	Fipronil	Regent	80 WG	0.05 g/l
4.	Mites	Abamectin	Vertimec	1.9% EC	0.25 ml/l
5.	Mites	Floramite	Bifenazate	240 SC	0.50 ml/l

12.9 Cost:Benefit ratio of mealybug IPM

IPM module and farmers practice were evaluated for the management of mealybugs against control practices and results indicated that a mean of 1.83, 15.61 and 25.50 per cent of bunch damage was recorded in the treatments IPM, farmer's practice and check respectively. Cost: Benefit ratio for IPM was worked out to be 1:3.46.

Programme 13. Management of agrochemical residues and environmental contaminants in grapes

13.1 Studies on dissipation rate of new generation pesticides with reference to changing MRLs

13.1.1 Dissipation of the fungicide Trifloxystrobin + Tebuconazole in grapes in combination

The residues of Trifloxystrobin as well as tebuconazole were below the EU-MRL of 5 and 2 mg/kg, respectively on the day of spraying itself. The dissipation in both pesticides at single dose followed 1st + 1st order rate kinetics; whereas, at double dose, the dissipation data correlated to simple 1st

order kinetics. Trifloxystrobin monocarboxylic acid, which is reported to be biologically inactive and not included in residue definition, was identified as the major metabolite and detectable in grapes up to 15 days from the date of spray. The results indicate that hydrolysis could be the major pathway of metabolism for Trifloxystrobin.

13.1.2 Metabolic degradation of insecticide fipronil in grapes and its processed products

Fipronil residues degraded to EU-MRL of 0.005 mg/kg in PHI of 45 days. The major metabolite desulfinyl-fipronil was relatively less toxic, the residues of which increased up to 15th day and then further dissipated to unknown compounds. When the grapes were processed to raisin, fipronil mainly converted to its highly polar sulfone metabolite, indicating enzyme-mediated oxidation as the major pathway.

13.2 Monitoring of agrochemical residues in grape and processed grape products

13.2.1 Development of multiresidue method

A multiresidue analysis method was optimised for 185 compounds in grape and wine based on two dimensional gas chromatography (GCxGC, 2-D) hyphenated to time-of-flight mass spectrometry (TOF-MS). The compound mixture consisted of 160 pesticides and environmental contaminants viz. bisphenol A, 12 dioxin-like polychlorinated biphenyls (PCBs) and 12 polyaromatic hydrocarbons (PAHs). The samples prepared by our previously reported method were analysed by both one-dimensional (1-D) GC-TOF-MS and two-dimensional (2-D) GCxGC-TOF-MS. Comparison of the results from the optimised programs in 1-D and 2-D indicated the limitation of 1-D separation in terms of non-detection of 25 pesticides and 2 PCBs owing to poor resolution and masking of the target signals by co-eluting natural matrix compounds like fatty acids, vitamins, esters, etc. having fragment ions characteristically common with the target analytes. Over the 2-D mode, all the 185 compounds could be successfully separated within 38 minutes with more than 85% NIST library-based mass spectral confirmations. Separation by GCxGC significantly increased the signal-to-noise ratio (S/N) of most of the pesticides by 5-12 times; whereas for PCBs and PAHs, the S/N increased by 10-15 times with concomitant improvement in limit of detections (LOD) and limit of quantifications (LOQ). The variable matrix effect in grape and wine, quantified as the ratio of the slope of matrix-matched to solvent calibration equations was within 0.5-1.5 for the range of target analytes. LOQ of most of the analytes in 2-D was $\leq$10µg/l with exceptions of difenconazole, dimethomorph, oryzalin, acephate, indoxacarb, thiabendazole, deltamethrin, omethoate and vamidothion, which was in the range of 12.5 to 25µg/l. Average recoveries of the test compounds ranged between 70-120 per cent with less than 20 per cent expanded measurement uncertainties for 151 and 148 compounds in grape and wine, respectively. Higher (>20%) measurement uncertainties were noted for the isomers of cypermethrin and cyfluthrin, dimethomorph, oryzalin, monocrotophos, iprodione, indoxacarb, difenconazole, and methamidophos. Intra-laboratory precision in terms of Horwitz ratio (HorRat) was satisfactory and below 0.2 for almost all analytes. GCxGC-TOF-MS was thus found to be the most promising for non-target screening of contaminant residues in a regulatory environment.

13.2.2 Monitoring of agrochemical residues in exportable and domestic samples

Almost 300 export grape samples were assessed for their compliance to the EU-MRL. The samples were collected from export pack houses, farms and nominated testing laboratories and screened for 95 test pesticides as per the CIB guidelines of the Government of India. In all samples, the residues were found to be below their respective MRLs indicating the successful implementation of the pre-harvest residue monitoring program at the country level.

More than 50 domestic samples were collected from farm gates, local markets and super markets and evaluated with respect to the MRLs specified under the Prevention of Food Adulteration Act of the Government of India and in all samples, the residues were found to be below the PFA MRL.

13.2.3 Monitoring of agrochemical residues in Indian wine

Samples collected from different Indian wineries were mostly free from pesticide residues. In case of any detection, the residue levels were within 1-5 ppb, which is much below the tolerance limit. Around 60 samples of red and white wines were evaluated as a part of the initiative to establish the quality standards of Indian wines.

13.2.4 Standardization of pre-harvest sampling technique for grapes from field

This experiment was repeated for the second year. Collection of 5 kg grapes out of 1.2 ha of vineyard area in the form of bunchlets was proved to be accurate sampling technique as observed in the previous grape season of 2008. The error (relative standard deviation) associated with sampling increased from <10% to more than 20% when same amount of grapes were collected from an area above 1.2 to 2 ha.

13.3 Persistence studies of agrochemical residues in soil and water

Degradation of the insecticide fipronil was explored in detail in three major soil types of India viz. silty-clay, clay and sandy-loam. The nature of degradation was variable with difference in physico-chemical properties of the soils. In all cases, fipronil was at first oxidized to sulfoxide, which further converted to the corresponding sulfone on oxidation. In all the soils, the residues of both fipronil and fipronil-sulfone were detectable up to 90 days. Beyond 90 days, fipronil could not be traced; however, the sulfone metabolite was still detectable and its major build-up was recorded in silty-clay followed by clay soil. In clay soil, on 90th day, the degradation process reached equilibrium with same concentration being detected for fipronil and fipronil-sulfone. Since fipronil-sulfone is much polar than the parent compound, being water soluble, it has potentiality to further leach to deeper soil layers and degrade to unknown degradation products. No appreciable degradation could be observed in sterilized soil, which indicates that the degradation was mediated by soil microbes.

Programme 14. Development of post-harvest technologies

14.1 Wine

14.1.1 Standardization of pre-harvest factors for production of quality red wines

The experiments on Cabernet Sauvignon and Shiraz wine grape varieties were conducted at Sula Vineyards Dindori, Nasik to study the effect of pruning time and crop load on wine quality. The vines were pruned at four different dates viz. 27th August, 5th September, 16th September and 28th September. Similarly different number of canes per vine viz. 12, 14, 16, 18 and regular practice of vineyard (as control) was maintained. In another experiment number of bunches per vine were varied and 30, 40 and 50 bunches per vine were retained. Mature bunches from all the treatments were harvested and fermented using a commercial yeast strain Premier Cuvee.

Preliminary results indicated that pruning time as well as crop load affected various quality parameters of must and wine in both the varieties. In Cabernet Sauvignon, maximum alcohol content (12.3%) was obtained in wine made from bunches harvested from vines pruned on 28th September, while in Shiraz, alcohol content was maximum (11.9%) in wine from bunches from 5th September pruned vines. Number of canes per vine affected must and wine quality parameters. Maximum anthocyanin was found in must from control of both the varieties.

14.1.2 Effect of yeast strain on biochemical changes during fermentation

The present study was conducted to compare the commercial and locally identified yeast strains and their effect on biochemical parameters during fermentation. Three commercial strains viz. KIV 1116, EC 1118 and Premier Cuvee and three local strains viz. RS1, RS2 and RS3 were used for fermentation of must of Cabernet Sauvignon. Quality parameters of young wines, viz. pH, TTA, anthocyanin content, colour intensity, phenolics, reducing sugars, free and total SO_2 and alcohol were analysed. Significant differences were obtained among different strains for all the analysed parameters. Wine made from inoculation of EC 1118 strain contained 11.06 per cent alcohol. The anthocyanin content differed significantly among all the yeast strains. Maximum anthocyanin content was found in wine prepared from RS1 (15.70 g/l). Maximum colour intensity (14.66) was observed in RS 2 yeast strain. The wines made from locally identified yeast strains contained more antioxidant reducing power (FRAP) than commercially available yeast strains. Significant differences for FRAP were observed among the yeast strains. Minimum free SO_2 (160mg/l) was recorded in wine made with RS3 and closely followed by RS1, EC 1118 and Premier Cuvee with a value of 176 mg/l. The locally identified yeast strains were found on par with commercial yeast strains. These strains can be used for further studies on other important varieties.

14.2 Raisins

14.2.1 Standardization of techniques for minimization of browning in raisins

I. Concentration of ethyl oleate and potassium carbonate

Mature berries of Thompson Seedless (TSS ~ 23°B) were used to study the effect of ethyl oleate and potassium carbonate on raisin quality. Three different concentration viz. 10, 15, and 20 ml of ethyl oleate and three concentrations viz. 20, 25 and 30 g of potassium carbonate were used in

combination. The berries were dipped in the solution of different treatments and dried in raisin shed for 15 days. Moisture content, colour intensity and phenol content were analysed after 15 days.

The data in table 24 indicated that raisin quality parameters were affected by dipping of bunches in various combinations of ethyl oleate and potassium carbonate. Although the rate of initial moisture loss was more when bunches were dipped in solution of 15 ml ethyl oleate and 30 g potassium carbonate (Fig. 20), minimum moisture content (10.27%) in raisins was obtained in treatment of 20 ml ethyl oleate and 30 g potassium carbonate whereas maximum moisture content (18.84%) was with 10 ml ethyl oleate + 20 g potassium carbonate. Minimum colour intensity was recorded in raisins which were produced by dipping of grape bunches in a solution of 20 ml ethyl oleate and 20 g potassium carbonate. Phenol content was maximum (1.07 mg/g) in raisins treated with 20 ml ethyl oleate and 30 g potassium carbonate. In general, 20 ml ethyl oleate in combination with various doses of potassium carbonate was found to be suitable for the production of raisins with lower colour intensity.

Table 24. Effect of combinations of ethyl oleate and potassium carbonate on raisins quality

Sl. No.	Treatments	Moisture (%)	Colour intensity	Phenols (mg/g)
1	10 ml Ethyl oleate + 20 g Potassium carbonate	18.84	0.71	1.04
2	10 ml Ethyl oleate + 25 g Potassium carbonate	17.35	0.89	0.87
3	10 ml Ethyl oleate + 30 g Potassium carbonate	11.43	1.02	0.80
4	15 ml Ethyl oleate + 20 g Potassium carbonate	15.18	0.87	0.96
5	15 ml Ethyl oleate + 25 g Potassium carbonate	13.50	0.64	0.81
6	15 ml Ethyl oleate + 30 g Potassium carbonate	13.08	0.63	0.77
7	20 ml Ethyl oleate + 20 g Potassium carbonate	13.35	0.57	0.89
8	20 ml Ethyl oleate + 25 g Potassium carbonate	12.47	0.58	0.93
9	20 ml Ethyl oleate + 30 g Potassium carbonate	10.27	0.69	1.07
	SEM±	0.164	0.019	0.009
	LSD at 5%	0.480	0.055	0.027

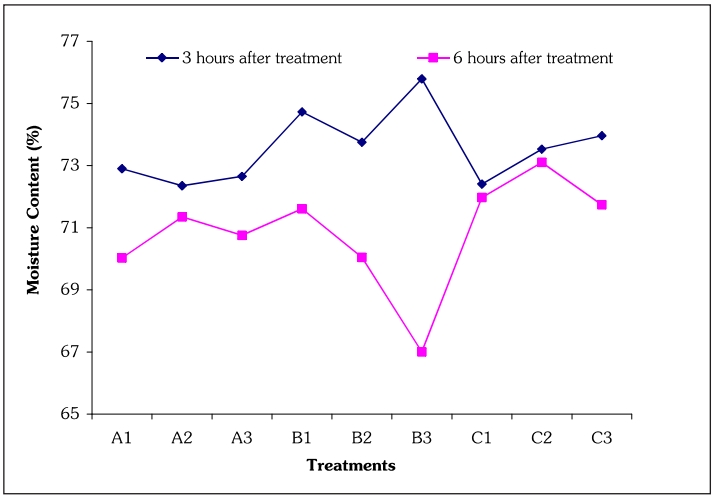


Fig. 20. Initial moisture loss in berries with different treatments

II. Dipping time and drying environment

In another experiment, the effect of drying environment and dipping time on colour intensity and phenolics was studied. The bunches of Thompson Seedless were treated with a combination of 15 ml ethyl oleate and 25 g potassium carbonate for 1, 2, 3 and 4 minutes and dried under raisin shed and dryer (at a temperature of 35± 2°C). After drying of 36 hrs, a spray of 1% ascorbic acid was also applied under dryer. In both the drying conditions, dipping for 4 minutes resulted in lower colour density.

Programme 15. Development of information and documentation systems

15.1 Development of Data Bank on Grape

A format for data collection was prepared and correspondence was made with grower associations and state department of horticulture of different states. Follow-up correspondence was also made to get the reply. Data has been received from a few state horticulture departments. A Database program to store and retrieve data on grape production statistics was developed in MS Access. A database on varieties/accessions distributed by the Institute under material transfer agreement was created along with the facility to store and retrieve the data reports.

15.2 NRCG - DIPS - A system for diagnosis and management of important diseases and insect pests of grapes

This new project was started in May 2008 and was proposed with the objectives to create an electronic database for grapevine diseases and insect pests; and developing application software for diagnosing of these problems and offer guidelines on different aspects of management under Indian agro-climatic conditions. The database development will do the electronic cataloguing of the

substantial information on diagnostic symptoms, pest biology, disease/life cycle, epidemiology and management of all the major diseases and insect pests of grapes. The project will result in user friendly software. The grape growers can use this software as ready reference tool for diagnosis and management of diseases and insect pests under Indian agro-climatic conditions.

During the period of reporting Information was collected on pests and diseases and system was analysed. System requirements were identified and logical model of the system was developed. The information on grapevine insect pests have been compiled and displayed by creating web-pages using HTML. The information on anthracnose, powdery mildew and downy mildew diseases was compiled. Compilation and display of information by creating web-pages using HTML on grapevine diseases is under progress.

15.3 Creation of molecular database for Indian grape germplasm (part of DBT funded project on molecular characterisation)

Analysis of System and user requirements

The system was analysed and user requirements were identified. The program should provide following functionality: The database should store molecular data generated from different molecular marker techniques for grape germplasm at this Institute. The program should facilitate in user-friendly manner storage of this data to the database, editing of already stored band, variety and primer data through user-friendly screens, maintain masters for data on variety available at this Institute, marker class and primers with details, generate report based on different criteria, facilitate identification of new/unknown/duplicate variety, do parentage analysis, capable of exporting data into different file formats, facilitate database search based on primer, variety and band data.

Designing

The tables for Variety, Technique, Primer, TestData, BandTable, Login and TempTAB have been designed. GUI design, logical design and coding for several modules have been done. The modules are Application's menu, add/edit/delete variety data, add/edit/delete primer data, import of data from Excel file, edit/delete allele data.

Collaborative, Externally Funded, Contract Research and Consultancy Projects

Collaborative and externally funded projects

i. National Referral Laboratory for monitoring pesticide residues for export of table grapes from India to EU countries (funded by APEDA)

This was the sixth year of the Residue Monitoring Plan, initiated by the APEDA in 2003-04 with National Research Centre for Grapes, Pune by setting up National Referral Laboratory under this institute. The total number of registered farms for export of table grapes for the year 2008-09 was 23883. Out of these farms, 23524 farms were from Maharashtra alone and 192 and 167 farms from Andhra Pradesh and Karnataka, respectively. The total area registered for export of table grapes was about 15912.62 hectares as against the estimated acreage of 64,300 hectare in the country. Eleven nominated laboratories under the APEDA from different parts of the country participated in residue monitoring during this period.

Proficiency Testing (PT) was organized among the participated nominated laboratories in two rounds by distributing unknown residue description among the laboratories at random and they were asked to submit the results within four working days. The laboratory results were then compared to the true values and the 'Z'-score was determined for individual chemicals of different laboratories as per the International Harmonized Protocol for the Proficiency Testing of the Analytical Laboratories (2005) issued by the International Union of Pure and Applied Chemistry. The results were found to be overall satisfactory and showed further improvement as compared to the earlier seasons.

A total of 5686 samples were analyzed in the nominated laboratories out of which 5399 were first samples and 287 were repeated for analysis second time. A total 359 alerts were issued out of which 157 alerts were withdrawn on re sampling. Out of the 202 effective alerts, most of the cases correspond to those pesticides, which are mostly used during the last two months before harvest. The maximum number of alerts was pertaining to Chlorpyriphos, which might have occurred as a result of foliar applications of this chemical against insect pests.

On critical perusal of the results of the residue monitoring during this year, it is evident that the percentage of the failed samples has reduced significantly to nearly 3.5 per cent from 23.69 per cent in 2003-04. The extent of failure remained static since 2007-08. This clearly shows the improvement in the management of pesticide residues in grapes at the country level through the implementation of the residue monitoring program.

ii. National integrated fruitfly surveillance programme (funded by Union Ministry of Agriculture and Cooperation / APEDA)

A national integrated fruitfly surveillance project was developed as joint collaboration programme, for implementation by the Directorate of Plant Protection, Quarantine and Storage under the Department of Agriculture and Cooperation of Ministry of Agriculture, Indian Council of Agriculture Research and State Agriculture Universities (designated).The main aim of the project was to develop a sustained system of fruitfly surveillance with a view to establish pest free areas so as to gain market access for export of fresh fruits particularly mangoes through sustained fruitfly free productions and quality exports. All the export of mangoes will be from the designated areas covered under the national fruitfly surveillance programme operated by the Ministry of Agriculture and Cooperation,

Govt. of India in association with ICAR institutes and the State Agriculture Universities in the respective states of Maharashtra, Gujarat and Andhra Pradesh. The survey and monitoring for fruitflies was carried out as per the guidelines established by the Plant Protection Adviser in line with international standards established under the IPPC and as per the national programme on fruitfly surveillance.

The Institute worked as Zonal coordinating centre for West zone comprising BSKKV, Dapoli, NAU, Navsari and ANGRAU, Hyderabad for the Project entitled "National integrated fruitfly surveillance programme". This Institute coordinated and monitored activities of all the three centres. During the period, one training programme and three review meetings were organized. Training for the surveillance inspectors of all the three cooperating centres was conducted and meetings were held involving the officials coordinating Centres and officers of Directorate of Plant Protection, quarantine and storage, Ministry of Agriculture and Co-operation, Govt. of India.

Field survey and laboratory studies were also conducted in our experimental vineyards and it revealed very low incidence of fruitfly and no fruit fly damage both in the vineyards of NRC for Grapes in Pune and the vines with artificial inoculation. The populations of two species namely *Bactrocera dorsalis* and *B. zonata* ranging from 0.25 to 1.25 were collected. No fruitfly incidence was noticed in the grapes harvested from vineyards and emergence of adult fruitfly was not observed from bunches kept both at room temperature (27 to 28°C) and in cold storage (°C). These results suggested that fruitflies observed in the field might have been attracted from nearby vegetable fields.

iii. Use of plastic cover for control of downy mildew during adverse conditions of off season production of Sharad Seedless grapes (funded by APEDA)

Sharad Seedless is popular table grape variety. However, it is susceptible to downy mildew, and often pruned early in September or October for making grapes available in December–January to fetch better price. The same variety if pruned in August, its early growth is subjected to adverse conditions of rains during August-September, where major cause of damage and loss is due to infection of downy mildew. However, when protected from downy mildew, it can be harvested in the month of November. The growth under plastic cover can develop good sugar due to relatively high temperatures and can be sold at premium cost.

The polyhouse like structure was used to cover Sharad Seedless plants in vineyard with plastic to protect from direct rain. Both plastic covered and open plants were forward pruned on 16th August 2009. There was heavy precipitation during early growth of new shoots and weather was highly suitable for downy mildew. The severe outbreak of downy mildew was observed in vines outside plastic in spite of heavy fungicide sprayings and crop could not be saved. But there was negligible infection inside plastic, which was controlled with few sprays and good crop was harvested.

In a failed attempt to control downy mildew vines growing outside plastic received 14 sprays during early stages of growth in which 12 sprays were of systemic fungicides (Dimethomorph, azoxystrobin, metalaxyl etc.) while 2 sprays were of non-systemic fungicide (copper hydroxide). During the same period inside plastic cover downy mildew was effectively controlled by 3 fungicide sprays including 2 systemic and 1 non-systemic. In one of the plastic structure due to trench dug for laying pipeline, rain

water entered inside and downy mildew symptoms developed on few leaves at one side of the structure. Plants inside this structure received two additional sprays of systemic fungicides for the control of downy mildew.

Inside plastic cover downy mildew PDI (Per cent Disease Index) on leaves and bunches was 1.20 and 0.29 as against 16.55 and 95.00 respectively in vines outside plastic. Till harvesting even partially infected bunches got spoiled and only 0.052 kg per vine yield was harvested outside plastic cover as against 6.15 kg per vine under plastic cover.

In shelf life studies grapes harvested from vines inside plastic cover did not develop berry rots up to 12 days of storage at room temperature against 5 days of storage from outside plastic. Studies on microflora of air showed significantly high microflora count outside plastic cover as compared to inside plastic cover.

All results indicate that plastic cover can be effectively used for early production of Sharad Seedless grapes under adverse conditions of monsoon.

Fig. 21. Vines under the plastic cover

Fig. 22. Vines outside plastic cover

iv. Identification of drought and salt stress inducible genes in grape rootstocks and their role in physio-biochemical responses under abiotic stresses (funded by BARC-BRNS)

Hard wood cutting of rootstocks Dogridge (*Vitis champinii*); Salt Creek (*Vitis champinii*), St. George (*Vitis rupestris*), 1613 C (Solonis × Othello), 110 R (*Vitis berlandierii* × *Vitis rupestris*), 99 R (*Vitis berlandierii* × *Vitis rupestris*), 1103 P (*Vitis berlandierii* × *Vitis rupestris*), B2/56 (*Vitis berlandierii* × *Vitis rupestris*), *Vitis longii*, Teleki 5 A (*Vitis berlandierii* × *Vitis riparia*) were raised in nursery bed, transplanted to plastic pots and maintained till 6 months to impose salinity stress. Two stress of salinity viz. 2 EC and 4 EC using were applied using saline water as irrigation water for 25 days.

In all the rootstocks toxicity symptoms developed under 4 EC. Early symptoms were observed on *Vitis longii*, 1613 C, 99 R, 110 3 P and 110 R, while late symptom were observed in Dogridge and Teleki 5 A. No symptom was developed in Salt Creek on 25th Day of stress cycle. Rootstocks 1103 P, Teleki 5 A, 1613 C, *Vitis longii* developed symptoms at lower levels of 2 EC also, however rootstocks such as 110 R, Dogridge, Salt Creek and 99 R didn't show toxicity symptoms at 2EC salinity.

Water relation parameters

At the end of the stress cycle highest osmotic adjustment was recorded in most of the rootstocks at 2 EC level while, at 4 EC, the maximum osmotic adjustment in terms of increased osmotic potential was recorded in Salt Creek, Dogridge, 110 R and Teleki 5A whereas least adjustment was observed on other rootstocks.

Similarly, regarding maintaining cell turgidity by lowering water potential, maximum water potential was recorded in all the rootstocks with no significant difference under 2EC level at the end of the stress cycle (i.e., most of the rootstock could tolerate salinity at 2 EC level). Significant difference was recorded in water potential at the end of the stress cycle at 4 EC level with maximum recorded in Salt Creek, B2/56, Dogridge, 110 R and Teleki 5 A. Least water potential was recorded in 1103 P, 99 R, 1613 C, Vitis longii.

Biochemical parameters

Significant differences were recorded among rootstocks in accumulation of reducing sugars, total phenols and protein content at both 2 EC and 4 EC level at the end of the stress cycle. At 2 EC level, most of the resistant rootstocks such as 110 R, Dogridge, Salt Creek, B2/56 had maximum reducing sugar while at 4 EC level, most of the susceptible rootstocks accumulated maximum reducing sugars at later stages of stress cycle. Protein content increased with increase in salinity stress and this could be due to accumulation of stress tolerant proteins. Salt Creek, B2/56, 110 R and Dogridge recorded highest protein accumulation at 4 EC while least was in 1613 C, *Vitis longii*, Teleki and 99 R. Accumulation of phenolic compounds was highest in most of the rootstocks at 2 EC level, while at 4 EC level there was slight decrease in the protein accumulation even in the resistant varieties such as Salt Creek, B2/56, 110 R.

Gas exchange parameters

Not much difference was observed for various gas exchange parameters like rate of photosynthesis, transpiration rate and water use efficiency at single leaf level on different days of salinity cycle.

However, water use efficiency was highest on rootstock like Salt Creek, 110 R at 4 EC level at the end of stress cycle.

v. Molecular characterization and creation of molecular database for Indian grape germplasm (funded by DBT)

Report presented under 3.1 and 15.3

Technology Assessed and Transferred

Several technologies were developed and assessed during this period at the Institute and disseminated to the grape growers through several field visits, participation in growers' seminar and by organizing training programmes at Institute or their site as per the request. Some of the important technologies which were disseminated are given below :

1. Use of rootstocks for sustainable grape production under abiotic stress
2. Irrigation schedule, use of mulch and subsurface irrigation under water deficit conditions
3. Rationalisation of fertilizer use
4. Use of bioregulators for improving grape quality
5. Strategies for insect pest and disease management during last 50 days before harvest
6. Use of biocontrol agents
7. Disease forecasting

Farm Visits

- Dr. R.G. Somkuwar visited the grape vineyards of Tikota and Bijjargi on 5th June 2008. The grape cultivation in these areas is on light type of soil. The temperature also goes above 42°C during April-May month. The spacing used by the grape growers of the region is 3.66 m × 1.83 m accommodating lesser plants. Due to high temperature and light soil, the growth reduces in

both the seasons. Hence, the growers were advised to maintain the spacing as 2.74 m × 1.52 m for future planting. The cultural practices like shoot thinning, shoot tipping and training the vines followed by the grape growers are not appropriate. Through a lecture on 'Production of exportable quality grapes' approximately 100 grape growers were advised to follow proper cultural practices in both seasons to achieve maximum bud differentiation and reduce the disease incidence in the canopy.

- Vineyards severely affected by pre-monsoon wind, hailstorm and rains in Narayangaon and Junnar area were visited by Dr. S.D. Sawant, Dr. R.G. Somkuwar, Dr. J. Sharma and Dr. N.S. Kulkarni on 6th June 2008.

There was rainfall of 122 mm in just 20 minutes along with the hail storm and heavy wind. As a result, all the leaves on shoot were torned and fallen resulting in complete cane defoliation. These canes also showed symptoms of bark damage. The stage of crop was approximately 40-60 days after foundation pruning, a critical stage for productivity. Such canes generally do not differentiate in to fruit buds and there was possibility of complete crop loss in the affected vineyards. Such vineyards were very prone to the bacterial and fungal diseases. To minimize the losses, the growers were advised not to prune again and allow new shoots to grow on the existing canes and follow regular practices of fertilizers and hormone application as in the case with sub cane development. They were also advised to give foliar application of macro and micro nutrients. One immediate spray of Copper based fungicide (Bordeaux mixture 0.5 per cent or Copper Hydroxide 2.0 g/l, or COC 3.0 g/l) as prophylactic measure against fungal pathogens and drenching of plants with systemic fungicides on appearance of new shoots were also suggested.

- Dr. N. S. Kulkarni visited Stem borer affected vineyards at Sangli on 19th August 2008 to advise the farmers regarding its management.
- Dr. M. Mani visited Sula vineyards at Nasik on 27th August 2008 to study the mealybug incidence and plan strategy for its management.
- Dr. P. G. Adsule, Director visited vineyards and wine units in MIDC area of Palus and Sangli on 27th September 2008 and collected the wine samples for quality analysis.

- Dr. R. G. Somkuwar, Dr. A. K. Sharma and Dr. N. S. Kulkarni visited Satana area of Nasik district on 4th November 2008 for survey of downy mildew incidence. Almost all the vineyards of the region had suffered with downy mildew incidence. In some cases leafless conditions were also observed. The early pruned vineyards were the most affected by downy mildew. After assessing the situation of the affected grape gardens, the growers of the regions were given appropriate advice for saving the vines by back pruning at the earliest.
- Dr. N. S. Kulkarni visited vineyards in Sangli region and Manerajuri on 4th and 5th December 2008 respectively to check the stem borer incidence and chalk out the management programme.
- Dr. N. S. Kulkarni visited vineyards around Nasik region on 10th December 2008 and guided the growers on IPM of thrips, mealybugs and mites.
- Dr. P. G. Adsule visited the table and wine grape vineyards in Kolhapur and Sangli districts during 28-29th December 2008 and discussed with grape growers about the level of incidence of diseases, accordingly the strategies for management were suggested.
- Dr. P. G. Adsule, Dr. G. S. Karibasappa, Dr. S. D. Sawant, Dr. R. G. Somkuwar and Dr. Anuradha Upadhyay visited nursery of M/s Chateau Indage Pvt. Ltd. at Bota, Narayangaon on 12th February 2009 to discuss the strategies for monitoring genetic purity and virus indexing of planting material.
- Dr. P. G. Adsule Dr. G. S. Karibasappa, Dr. S. D. Sawant, Dr. R. G. Somkuwar, Dr. A. K. Upadhyay and Dr. A. K. Sharma visited M/s. Grovers Vineyards on 20th March 2009 and held discussion with their Vice-Chairman about various contract vineyard farms for supply of wine grapes to the winery and their problems. On 21st March 2009, the team visited Indian Institute of Horticultural Research (IIHR), Bangalore and held discussion with the Head of Divisions, particularly, Plant Pathology, Entomology, PHT, Horticulture and Biotechnology.

  During this visit the team reviewed experimental vineyard farms of M/s Grovers Vineyards and IIHR to know the germplasm collection and the performance of Red Globe and other varieties under the APEDA sponsored project in the 2003.
- Dr. P. G. Adsule and Dr. G. S. Karibasappa visited M/s Bafna Farms to observe the performance of Manjri Naveen, Thompson Seedless and Fantasy Seedless. The *in situ* grafting success, growth and performance of these cultivars on 110R rootstock were also observed.

Participation in Growers' Seminar

- Dr. P. G. Adsule participated in the seminar organized by Maharashtra State Grape Growers' Association, Sangli Unit on 21st April 2008 and shared the experiences on monitoring of pesticide residues in exportable grapes of Sangli region during grape season of 2008 with grape growers for appropriate care and management for the next grape growing season. Also visited some of the vineyards in the border of Sangli-Kolhapur region and guided the grape growers.
- Dr. S. D. Sawant, Dr. R. G. Somkuwar, Dr. J. Sharma and Dr. N. S. Kulkarni delivered lectures in their respective fields in seminars organized by Maharashtra State Grape Growers' Association

on 21st April, 9th May, 11th May and 13th May 2008 at Sangli, Solapur, Nasik and Sirgonda respectively. Approximately 7000 grape growers benefited.

- Dr. N. S. Kulkarni guided on 'IPM After April Pruning' in grape growers seminar organized by Basaveshwara Agro Grower's Organization at Bijapur on 5th June 2008.
- Dr. S. D. Ramteke and Dr. N. S. Kulkarni delivered lectures on 'Judicious use of bioregulators in grapes' and 'IPM in grapes' respectively in the Maharashtra State Grape Growers' Association's annual seminar on 31st August 2008.
- All the scientists participated in Maharashtra State Grape Growers' Association's Annual Seminar during 2nd September 2008 and delivered lectures pertaining to their field of specialization.
- Dr. N. S. Kulkarni delivered lecture on 'IPM after October Pruning' in Charchasatras organized by Maharashtra State Grape Growers' Association on 15th, 16th, 17th, 18th and 19th September 2008 at Sangli, Solapur, Latur, Nasik and Pravaranagar respectively.
- Dr. N. S. Kulkarni delivered a lecture on 'IPM of mealybugs and stem borer' in the growers seminar organized by Department of Horticulture, Govt. of Maharashtra at Tasgaon and Vita on 26th September and 7th October 2008 respectively.
- Dr. N. S. Kulkarni delivered a lecture on 'IPM of mealybugs and thrips' in the growers seminar organized by State Bank of India at Niphad on 30th September 2008.
- Dr. N. S. Kulkarni delivered a lecture on 'IPM of Stem borer' in the growers seminar organized by Grape Grower's Organization at Sangli and Manirajuri on 4th and 5th December 2008 respectively.
- Dr. N. S. Kulkarni delivered a lecture on 'IPM of thrips, mealybugs and mites' in the growers seminar organized by Grape Grower's Organization at Nasik on 10th December 2008.
- A group meeting of grape growers was organized jointly by the Institute along with the local Grape Growers Association at Walva, district Sangli on 29th January 2009. Dr. P. G. Adsule, Dr. S. D. Sawant, Dr. R. G. Somkuwar, Dr. S. D. Ramteke and Dr. N. S. Kulkarni participated in the group meeting. Dr. P. G. Adsule educated the grape growers about the pesticides to be used for the best management of downy mildew disease in grapes. Dr. R. G. Somkuwar delivered lecture on 'Cultural practices to be followed for the production of Sharad Seedless grapes' at the gathering of approximate 200 grape growers.

  The team also visited grape vineyards in nearby area. Dr. S. D. Ramteke observed abnormal swelling of knot. The growers were advised not to put vines under stress and apply bio-stimulant to enhance the supply of metabolites towards the berries.
- Dr. N.S. Kulkarni delivered a lecture on 'IPM of mealybugs and thrips' in the growers seminar organized by Department of Horticulture, Govt. of Maharashtra at Nasik on 4th February 2009.

- Dr. N.S. Kulkarni delivered a lecture on 'Organic pest management in grapes' in the growers seminar organized by INORA, Pune at Dindori, Nasik on 5th February 2009.

In house discussions

- Approximately 750 farmers visited the Institute during this year to seek advice, consultancy for their problems being faced in the grape vineyard from the scientists of this Institute apart from collection of improved plant varieties / rootstocks.

Education and Training

Deputation Abroad

- Dr. P. G. Adsule, Director visited Udine (Italy) from 26th July to 2nd August 2008 to develop some topics of common interest in the field of research in the sector of wine grape growing and wine making at the invitation of Italy Chamber of Commerce and Udine University. University of Udine has the best collection of different species of grape including hybrids, new clones and therefore there is need to obtain this information from University of Udine about germplasm stock and obtain the material which is absent in our germplasm at NRC Grapes. Further, Italy has the best source of plant material, machinery for winery and trained faculties in wine making.

- Dr. J. Satisha, Sr. Scientist (Horticulture) was deputed for availing Post Doctoral position in the Institute of Continental Climate Viticulture and Enology (ICCVE), College of Agriculture, Food and Natural Resources, Division of Food Systems and Bioengineering, University of Missouri, Columbia, USA for a period of one year from 09.08.2008 to 08.08.2009 (extendible till 08.08.2010).

- Dr. K. Banerjee was deputed to Manchester, UK for participation in the European Food Testing Summit during 15-18th October 2008.

- Dr. P. G. Adsule and Dr. R. G. Somkuwar undertook study visit to research organizations dealing with viticulture and enology (INRA, ENTAV, IFV, and ICV), nurseries, winery units, machinery fabricators and Vinitech exhibition in France during 2-13th December 2008. This visit was taken at the invitation of VINIFLHOR of Govt. of France.

- Dr. S. D. Sawant visited Grape Virology Laboratory of Irrigated Agriculture Research and Extension Centre, Prosser, Washington State University, Washington, USA, on deputation of one month from 12th October to 12th November 2008. This visit was to know incidence of virus in grape plantings in USA and acquaint with modern techniques for their detection and further analysis.

Training Acquired

- Dr. Indu. S. Sawant and Dr. S. D. Sawant participated in 'Hands on training program on plant virus diagnostics' organized by Advance Centre for Plant Virology Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi during 7-13th June 2008. The program was co-ordinated by Dr. V. K. Baranwal, Principal Scientist (Pl. Path.), at Division of Mycology and Plant Pathology, IARI, New Delhi.

Training Programmes Organized

- Drs. R. G. Somkuwar and N. S. Kulkarni imparted training on 'Canopy management' and 'IPM of insect pests in grapes' respectively to the grapes growers in the training programme organized by Basaveshwara Agro Food Processing Ltd., Bijapur on 4-5th June 2008.

- A 5 days training programme on 'Transfer of technology for production of export quality grapes' was organized during 16-20th December 2008. Twenty-five participants were benefited by the programme. This programme was sponsored by National Horticulture Board. Dr. A.K. Sharma and Dr. N.S. Kulkarni coordinated the training programme.

Resource persons for training programmes organized by Maharashtra State Grape Growers' Association

- Dr. M. Mani and Dr. N. S. Kulkarni imparted training on insect pest management during the training programme for grape growers organized by Maharashtra State Grape Growers' Association on 25th June 2008.

- The Institute provided assistance to Maharashtra State Grape Growers' Association in organizing their training programme during 7-19th July 2008 at Pune. All the scientists of this Institute worked as resource persons and delivered talks in their respective areas of viticulture and enology.

Awards and Recognitions

- Shivaji University, Kolhapur has recognized Dr. P. G. Adsule and Dr. K. Banerjee as guides for PG programmes.
- Drs. Indu S. Sawant, R. G. Somkuwar, S. D. Ramteke and A.K. Sharma were recognised by the University of Pune, for guiding and teaching M. Phil. (By papers/research) and for guiding Ph.D. students in the subject of Botany for a period of eight years w.e.f. 7th July 2008 to 6th July 2016.
- Dr. G. S. Karibasappa was nominated by Dy. Director General (Hort.), ICAR, New Delhi in the DPC meeting held on 11th June 2008 for career advancement of scientists at National Research Centre for Onion and Garlic, Rajgurunagar, Pune.
- Dr. G. S. Karibasappa acted as a rapporteur for the All India Coordinated Research Project on Subtropical Fruits - Grapes at the group discussion meeting held at Central Institute of Subtropical Horticulture, Lucknow on 29th June - 2nd July 2008.
- Dr. N. S. Kulkarni delivered a keynote address on "Eco friendly approaches of pest management in grapes" at "National Symposium on Eco-friendly approaches in sustainable agriculture and Horticulture Productivity" at Amity University, Lucknow from 27th November to 1st December, 2008
- Dr. K. Banerjee has been recognized as Member, American Chemical Society and also as Guest Editor for a Special Edition of the *Journal of AOAC International* on "New Methods for Single and Multiresidue Analysis of Pesticides".
- Dr. N. S. Kulkarni was awarded with best project preparation and presentation on "Strategies for the Management of Mealybugs" at International Workshop on Integrated Pest Management (IPM) in Grapes organized by FICCI from 26-30th May, 2008 at Hotel Taj Hyderabad.

Linkages and Collaboration Including Externally Funded Projects

Collaborating and Externally Funded Projects

i. National referral laboratory for monitoring pesticide residues for export of fresh grapes from India (APEDA).

ii. Introduction, evaluation and distribution of plant material of grape varieties suitable for export (APEDA).

iii. Use of plastic covers in vineyards to improve export per cent of grapes (APEDA).

iv. Identification of drought and salt stress inducible genes in grape rootstocks and their role in physio-biochemical responses under abiotic stresses (BARC).

v. Molecular characterization and creation of molecular database for grape germplasm in India (DBT).

Publications

Research Articles

1. Argade N. C., Tamhankar S. A., Karibasappa G. S., Patil S. G. and Rao V. S. 2009. DNA profiling and assessment of genetic relationship among important seedless grape (*Vitis vinifera*) varieties in India using ISSR markers. *J. Plant Biochemistry and Biotechnology*. Vol. 18(1) : 45-51.

2. Banerjee K., Dasgupta S., Oulkar D. P., Patil S. H., and Adsule P. G. 2008. Degradation kinetics of forchlorfenuron in typical grapevine soils of India and its influence on specific soil enzyme activities. *Journal of Environmental Science and Health*, Part B 43 : 1-9.

3. Banerjee K., Oulkar D. P., Patil S. H., Dasgupta S., Nikam A. T. and Adsule P. G. 2008. Sorption behaviour of forchlorfenuron in soil. *Bulletin of Environmental Contamination and Toxicology* 80(3) : 201-205.

4. Banerjee K., Patil S. H., Dasgupta S., Oulkar D. P., and Adsule P. G. 2008. Optimization of separation and detection conditions for the multiresidue analysis of pesticides in grapes by comprehensive two-dimensional gas chromatography - time of flight mass spectrometry. *Journal of Chromatography* A 1190 : 350-357.

5. Sharma J., Upadhyay A. K, Sawant S. D. and Sawant I. S. 2009. Studies on shiny spot symptom development on grapevine leaves and its effect on fruitfulness, disease incidence and vine yield. *Indian J. Hort*. 66 : 48-52.

6. Mani M. and Kulkarni N. S. 2007. Citrus mealybug Planococcus citri (Homoptera: Pseudocoeidae) - a major pest of grapes in India. *Entomon* 32(3) : 235-236.

7. Patil S. H., Banerjee K., Dasgupta S., Savant R. and Adsule P. G. (2008). Multiresidue analysis of 83 pesticides and 12 dioxin-like polychlorinated biphenyls in wine by gas chromatography - time of flight mass spectrometry. *Journal of Chromatography* A 1216 : 2307-2319.

8. Sharma A. K.; Singh S. R.; Srivastava K. K. and Sounduri A. S. 2008. Studies on walnut grafting as affected by time and environment. *Indian Journal of Ecology*. 35 (1) : 5-8.

9. Sharma A. K., Adsule, P. G. and Karibsappa, G. S. 2008. Grape juice ... take a sip for health. Available at http://krishisewa.com/articles/grapejuice.html.

10. Somkuwar R. G. and Adsule P. G. 2009. Comparative performance of grafted Thompson Seedless grapes with own rooted vines - A case study. *J. Mah. Agril. Uni.*, 34(1) : 114-116.

11. Somkuwar R. G., Satisha J. and Ramteke S. D. 2009. Propagation success in relation to time of grafting in Tas-A-Ganesh grapes. *J. Mah. Agril. Uni.*, 34(1) : 113-114.

Papers Presented at Symposia / Workshops / Meetings

1. Banerjee K., Oulkar D. P., Patil S. H., Savant R, Patil S. B., and Adsule P. G. (2008). Evaluation of matrix influence in ethyl acetate-based multiresidue analysis of pesticides in fruits and vegetables by liquid and gas chromatography coupled with mass spectrometry. Presented in 7th European Pesticide Residue Workshop, 1-5 June 2008, Berlin, Germany.

2. Banerjee K., Jadhav M. R., Oulkar D. P., Savant R. H., Dasgupta S. and Adsule P. G. Analysis of Meptyl Dinocap residues in grapes by HPLC coupled with Ultraviolet and Tandem Mass Spectrometric determination. Presented in 122nd AOAC Annual Meeting and Exposition in Dallas, Texas, USA , 21-24 September 2008.

3. K. Banerjee, D. P. Oulkar, S. B. Patil, S.H. Patil, S. Dasgupta, M. R. Jadhav, R. H. Savant, P. G. Adsule, Multiresidue Analysis of pesticides in wine by Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS). 122nd AOAC Annual Meeting and Exposition in Dallas, Texas, USA, 21-24 September 2008.

4. Banerjee K., Patil S. H., Dasgupta S., Jadhav M. R., Patil S. B., Savant R., Oulkar D. P., Adsule P. G., Simple multiresidue method for determination of pesticide residues in wine by Ethyl Acetate extraction and Gas Chromatography-Time Of Flight Mass Spectrometric (GC-TOFMS) determination. 122nd AOAC Annual Meeting and Exposition in Dallas, Texas, USA, 21-24 September 2008.

5. Banerjee K., Oulkar D. P., Ramteke S. D., Patil S. B., Kor R. J., Nandurkar K. S., Adsule P. G., Development and validation of a multiresidue analysis method for plant growth regulators in grapes by Liquid Chromatography Tandem Mass Spectrometry. 122nd AOAC Annual Meeting and Exposition in Dallas, Texas, USA, 21-24 September 2008.

Extension Bulletin

1. Mani M, Kulkarni N. S. Banerjee K and Adsule, P. G., 2008. Pest Management in Grapes. Extension Bulletin No. 2. National Research Centre for Grapes, Pune. 44 p.

2. Sawant S. D., Sawant Indu S., Kulkarni N. S. and Mani M, 2008. दोन वेळा छाटणी–एक बहार या द्राक्ष लागवडीच्या पध्दतीमध्ये महत्वाचे रोग व किडीच्या व्यवस्थापनेसाठी उपाय योजना. Extension Bulletin No. 3., pp. 32.

3. Mani M, Kulkarni N. S. Banerjee K. and Adsule, P. G. 2008. द्राक्षावरील किडी आणि कोळी यांचे व्यवस्थापन, Extension Bulletin No. 4., National Research Centre for Grapes, Pune. Pp. 56.

Technical / Extension Folders

1. Ramteke S. D., Somkuwar R. G. and Adsule P. G. 2008. Use of bioregulators and other practices to enhance the shelf life in grapes. Technical Folder No.17. National Research Centre for Grapes, Pune.

2. Ramteke S. D., Somkuwar R. G. and Adsule P. G. 2008. दाक्षांचे साठवणीतील आयुष्यमान वाढविण्यासाठी संजीवके आणि इतर बाबींचा योग्य वापर. Extension Folder No.18. National Research Centre for Grapes, Pune.

3. Mani M, Kulkarni N. S. and Adsule P. G. 2008. Production and use of Australian ladybird beetle Cryptolaemus montrouzieri. Extension Folder No.19. National Research Centre for Grapes, Pune.

4. Mani M., Kulkarni N. S. and Adsule P. G. 2008. Management of stem borer on grapes. Extension Folder No. 20. National Research Centre for Grapes, Pune.

5. Mani M., and Kulkarni N.S. 2008. द्राक्षावरील खोडकिड्याचे व्यवस्थापन. Extension Folder No. 21. National Research Centre for Grapes, Pune.

6. Kulkarni N. S., Mani M, Banerjee K. and Adsule P. G. 2008. Management of flea beetle and Chafer beetles on grapes. Extension Folder No. 22. National Research Centre for Grapes, Pune.

7. Kulkarni N.S., Mani M, Banerjee K and Adsule P.G. 2008. द्राक्षाची पाने खाणाऱ्या उडद्या भूंगेरे व इतर भूंगेरे यांचे व्यवस्थापन. Extension Folder No. 23. National Research Centre for Grapes, Pune.

8. Mani M., Kulkarni N. S., Banerjee K. and Adsule P. G. 2008. Management of Caterpillars on grapevine. Extension Folder No. 24. National Research Centre for Grapes, Pune.

9. Kulkarni N. S., Mani M. and Banerjee K. 2008. Management of Leafhopper on grapes. Extension Folder No. 27. National Research Centre for Grapes, Pune.

10. Kulkarni N. S., Mani M., Gawde S. H. and Banerjee K. 2009. द्राक्षपिकावरील तुडतुडे व त्यांचे व्यवस्थापन. Extension Folder No. 28. National Research Centre for Grapes, Pune.

11. Kulkarni N. S., Mani M., Gawde S. H. and Banerjee K. 2009. क्रिप्टोलाइम्स भूंगेरेंचा उपयोग व उत्पादन. Extension Folder No. 31. National Research Centre for Grapes, Pune.

Training Manual

1. Kulkarni, N. S. and Sharma, A. K., 2008, "Integrated Pest Management in grapes" in the training on " Transfer of technology for production of export quality grapes " at NRC for Grapes, Pune from 16-20th December, 2008. Sponsored by NHB, Pune 105 PP.

Meetings of QRT, RAC, IMC, IRC with Significant Decisions

Research Advisory Committee (RAC) Meeting

Following are the members of RAC :

1.	Dr. K. L. Chadha, Ex DDG (Hort.), ICAR, New Delhi	Chairman
2.	Dr. Y. R. Chanana, Emeritus Scientist, Department of Hort, PAU, Ludhiana	Member
3.	Dr. D. V. Singh, Ex-Head & Emeritus Scientist, Divn. Pl. Path., IARI, New Delhi	Member
4.	Dr. B. D. Singh, Dean, College of Science, BHU, Varanasi, Uttar Pradesh	Member
5.	Dr. M. D. Awasthy, Ex-Head (Soil Sci. & Agril. Chem.), IIHR, Bangalore	Member
6.	Mr. Rajiv Samant, Samant Soma Wines Ltd., Distt. Nasik	Member
7.	Assistant Director General (Hort.-I), ICAR, New Delhi	Member
8.	Dr. P. G. Adsule, Director, NRC for Grape, Pune	Member
9.	Mr. Mahendra S. Shahir, Bhavani Peth, Solapur	Member
10.	Mr. Ashok Vishnu Gaikwad, N.D. Wines Private Limited, Distt. Nasik	Member
11.	Dr. M. Mani, Pr. Scientist (Entomology), NRC for Grapes, Pune till 22.01.2009 Dr. Indu S. Sawant, Pr. Scientist (Pl. Path.), NRC for Grapes, Pune w.e.f. 10.02.2009	Member Secretary

The Research Advisory Committee meeting was held on 12-13th March 2009 under the chairmanship of Dr. K. L. Chadha, Ex. Deputy Director General (Hort.), ICAR, New Delhi. The other members present were Dr. Y. R. Chanana, Emeritus Scientist, PAU, Ludhiana; Dr. Dharam Vir Singh, Emeritus Scientist, IARI, New Delhi; Dr. M. D. Awasthi, Ex-Head, Division of Soil Science & Agril. Chemistry, IIHR, Bangalore; Dr. P. G. Adsule, Director, NRC for Grapes, Pune and Dr. Indu S. Sawant, Member Secretary.

RAC committee visiting grape drying unit

The Committee also interacted with Mr. Sopan Kanchan, Chairman, Grape Growers' Federation of India; Dr. J. M. Khilari, President, Maharashtra State Grape Growers' Association (MRDBS); Mr. B.M. Kokare, President, Karnataka State Grape Growers' Association; and Mr. Jaideep Kale, Technical Coordinator for Wine Industry of MIDC, Pune and got appraised on the current scenario and the research support required by the wine and raisin grape industry in view of the problems faced in the last year

The Committee also visited the grape drying units facilities at Junoni and interacted with the raisin manufacturers and wine makers. The Committee considered the views of the industry while reviewing the research programmes of the Institute.

Institute Research Committee (IRC) Meeting

The 13th Institute Research Committee meeting was held on 23-24th June 2008 under the chairmanship of Dr. P. G. Adsule, Director to review the progress made during the year 2007-08 and to discuss the technical programme for the year 2008-09.

The mid-term IRC meeting was held during 12-13th January 2009 under the chairmanship of Dr. P. G. Adsule, Director. The progress of the research projects along with the action taken report on the recommendations of previous IRC and RAC was presented by the project leaders. New project proposals were also presented.

Institute Management Committee (IMC) Meeting

Following are the members of IMC:

1.	Director, NRC for Grapes, Pune	Chairman
2.	The Director , Horticulture Commissionerate of Agriculture, Pune	Member
3.	The Commissioner of Horticulture, Andhra Pradesh, Hyderabad	Member
4.	The Associate Director of Research, NARP Plain Zone, RFRS, Pune	Member
5.	Mr. Mahendra Shahir, Bhawani Peth, Solapur	Member
6.	Mr. Ashok Vishnu Gaikwad, N.D. Wines Private Limited, Distt. Nasik	Member
7.	Dr. V.S.R.K. Prasad, Pr. Scientist, NRC for Onion & Garlic, Pune	Member
8.	Dr. Pious Thomas, Sr. Scientist, IIHR, Bangalore	Member
9.	Dr. M. Mani, Pr. Scientist, NRC for Grapes, Pune	Member
10.	Dr. Indu S. Sawant, Sr. Scientist, NRC for Grapes, Pune	Member
11.	Finance & Accounts Officer, CIRCOT, Mumbai	Member
12.	Mr. O. Babu, Assistant Admin. Officer, NRC for Grapes, Pune	Member Secretary

The Institute Management Committee meetings were held on 17th December 2008 and 25th February 2009 2008 under the Chairmanship of Dr. P. G. Adsule, Director.

All the agenda items were discussed and recommendations of the Committee were submitted to the Council for approval.

Meeting on mealybugs

A meeting to review the strategies for the management of mealybug infestation was held at the institute on 8th July, 2008. All the concerned stake holders working in this field viz., Project Directorate of Biological Control, Bangalore; National Research Centre for Integrated Pest Management, New Delhi; Agharkar Research Institute, Pune; Mahatma Phule Krishi Vidyapeeth, Rahuri; and AICRP on Biocontrol Pune, officials of State Department of Horticulture of Govt. of Maharashtra and representative of MRDBS and progressive grape grower Shri. Prakash Bafna, participated in the meeting. The meeting was conducted under chairmanship of Dr. P. G. Adsule, Director, NRC for Grapes, Pune. The meeting deliberated the action taken report of the previous meeting and worked out the future plan for mealybug management.

Meeting on stem borer

A team of Entomologists from NRC for Grapes, Pune, MPKV, Rahuri, and GRS, Hyderabad visited in and around areas of Sangli on 19-8-08 to survey the stem borer affected gardens. Several farms were found to be infested with the stem borer. On farm advice was given to groups of farmers and

during a meeting at MRDBS office at Sangli. All the details including stem borer's life cycle, seasonal incidence and management was discussed during these meetings. On 20th August 2008, meeting of entomologists from different institutes was held. Dr. Rangareddy made a presentation on stem borer, its biology, life cycle and management in the meeting and different strategies to manage this pest were discussed. It was also decided to include one experiment under AICRP.

Meeting of Wine Makers

As per suggestions of RAC, a meeting of winery units along with their viticulturists and wine grape farmers was organized at the Institute on 17th February, 2009, in order to assess the introduced wine grape varieties and their hybrids/clones developed by the Institute. Further, a deliberation of the status of Indian wines available in domestic market against the domestic quality standards (BIS) and also the OIV (International Wine Standards) was also conducted based on the analysis report prepared by the National Referral Laboratory of the Institute for Pesticide residue monitoring programme on grape, pomegranate and mango. The meeting was chaired by Dr. P. G. Adsule, Director of the institute.

After deliberations and in field assessment, several varieties/crosses were short listed for wine making. Among varieties Athens (A41-3), Sirius (A5-1), Tempranillo (A24-1), Pearl-of-Csaba (B10-3), Black Prince (A38-1) and Garganega (A43-1) and Crosses AH4-1-5 (Chardonnay x Arkavati), AH 4-33-34 (Chardonnay x Arkavati), AH 3-7 (for dual purpose as juice/wine), A 48-2 (Pusa Navrang x Chardonnay), AH3-27 (Chardonnay x Pusa Navrang), AH 3-26 (Chardonnay x Pusa Navrang) were selected.

First meeting of the Institute Variety Release Committee

A meeting of institute variety release committee was held on 14th November, 2008 under the chairmanship of Dr.P. G. Adsule, Director. The meeting was attended by Dr. S. N. Pandey, ADG (Hort.), ICAR, New Delhi, Dr. A. K. Mishra, Project Coordinator (STF), CISH, Lucknow and Dr. V. S. Rao, Director, Agharkar Research Institute, Pune (Expert Member), Mr. Prakash Bafna, a progressive grape grower, IVRC members and other scientists of the Centre. The meeting was convened to officially release two new table grape cultivars, A17-3 (A clonal selection from the introduced Centennial Seedless) and Red Globe.

In the beginning, Dr. P. G. Adsule briefed about the new varieties and varietal evaluation studies conducted by the Centre in collaboration with other institutes and the progressive grape growers in the participatory mode. The proposal for release was presented by Dr. G. S. Karibasappa, Principal Scientist (Horticulture) before the committee for the release of A17-3 for commercial cultivation under a new name and for the recommendation of Red Globe for commercial cultivation in India.

The yield and performance data of A17-3 in comparison to Thompson Seedless the reigning table grape variety were presented. The Passport information, salient morphological features of the new selection A17-3 in comparison with Centennial Seedless was also presented. The present proposal was based on participatory research conducted on-farm trials at 3 places 2 from grower vineyards and one at NRCG and evaluated for three consecutive years. A17-3 was at par with Thompson

Seedless for yield but was found superior in respect of recovery of exportable yield. The cost of cultivation was also significantly less due to less number of operations required for berry thinning, hormonal application, grading and sorting etc. This selection was released with the name Manjari Naveen.

In the second proposal, Dr. G. S. Karibasappa presented the details for recommendation of an introduced variety 'Red Globe' for commercial cultivation in Maharashtra and adjoining grape growing states based on APEDA sponsored multi-locational trials conducted at Nashik, Phaltan and NRCG, Pune which was evaluated for 3 consecutive years. Red Globe was found superior to Crimson Seedless and Italia in respect of fruit yield and qualities including the shelf life. Finally it was decided to officially recommend Red Globe variety for cultivation under Indian conditions.

The committee suggested to come out with suitable package of practices for each of the varieties recommended/released under different agroclimatic conditions and should be preferably based on evaluation studies.. This will help for easy adoption of new varieties by the farmers.

Consultancy, Patents and Commercialization of Technology

Distribution of planting material under MTA

Supply of plant material from the germplasm holding at the Institute was done during the year with 24 beneficiaries such as farmers, State Agricultural Universities and State Agriculture Departments from Maharashtra, Karnataka, Orissa, Madhya Pradesh, Arunachal Pradesh, Andhra Pradesh, Delhi and Gujarat. Among table grapes, A 18-3, Cardinal, Muscat Hamburg, Rizamat, Fantasy Seedless, Sharad Seedless, Red Globe, Flame Seedless, Sultanine-II, Manjri Naveen, Kishmish Rozavis White, Christmas Rose and Crimson Seedless were provided under Material Transfer Agreement. Among wine varieties Cabernet Sauvignon, Tempranillo, Grenache, Merlot, Shiraz, Athens, Sauvignon Blanc, Viognier, Chenin Blanc, White Sweet, Semillion, Symphony among juice varieties Pusa Navrang, Arka Shyam and Medika (Pusa Navrang × Flame Seedless), Country Bangalore, H-23, Gul × Bangalore Purple and among rootstock varieties Dogridge, 110R, 99R, Salt Creek and St. George were provided.

Approved On-Going Institute Programmes

1. Management of genetic resources of table, wine, raisin, juice and rootstock grape varieties
2. Germplasm utilization and genetic enhancement
3. Application of biotechnological research in grapes
4. Development of propagation and nursery technology
5. Use of rootstocks for grape cultivation
6. Horticultural practices for quality and yield in table and wine grapes
7. Nutrient and soil management in grapes
8. Water management in grapes
9. Grape physiology including use of bioregulators
10. Studies on viticulturally important microorganisms
11. Integrated disease management in grapes
12. Integrated insect and mite pest management in grapes
13. Management of agrochemical residues and environmental contaminants in grapes
14. Development of post-harvest technologies
15. Development of information and documentation systems

Participation of Scientists in Conferences, Meetings, Workshops, Seminars, Symposia etc.

Seminars / Symposia / Conferences

Name of the scientist	Seminars / Symposia / Conferences	Period	Organizer and place
Dr. A. K. Upadhyay	Combio 2008 Satellite Conference on 'Plant Energy and Water Productivity'	18-20th September 2008	Canbera, Australia
Dr. K. Banerjee and Dr. S. D. Ramteke	122nd AOAC International Meeting and Exposition. They also visited the GC-MS application laboratory of Thermo Fisher Scientific in Austin, Texas, USA.	21-27th September 2008	Dallas, Texas, USA
Dr. K. Banerjee and Dr. S. D. Ramteke	122nd AOAC International Meeting and Exposition. They also visited the GC-MS application laboratory of Thermo Fisher Scientific in Austin, Texas, USA.	21-27th September 2008	Dallas, Texas, USA
Dr. P. G. Adsule and Dr. G. S. Karibasappa	3rd Horticultural Congress	6-9th November 2008	OUAT, Bhubaneshwar, Orissa organized by HSI
Dr. Anuradha Upadhyay	International symposium on grapevine physiology and biotechnology	24-28th November 2008	Australian Society of Enology and Viticulture (ASEV), Adelaid
Dr. N. S. Kulkarni	National Symposium on Eco-Friendly Approaches In Sustainable Agriculture and Horticulture Productivity".	27th November to 1st December 2008	Amity University, Lucknow
Dr. P. G. Adsule, Dr. R. G. Somkuwar and Dr. A. K. Sharma	Maha Wine 2009-3rd International Conference and Expo on Grapes and Wines	16-17th January 2009	CII at Pune

Meetings

Name of the scientist	Title of meeting	Duration	Organizer and place
Dr. P. G. Adsule, Dr. G. S. Karibasappa Dr. R. G. Somkuwar and Dr. J. Satisha	Research Review Committee meeting of Horticultural Crops of the MPKV, Rahuri.	3-4th April 2008	MPKV, Rahuri
Dr. M. Mani	17th Biological Control Workers Group meeting	29-30th May 2008	Solan, Himachal Pradesh

Name of the scientist	Title of meeting	Duration	Organizer and place
Dr. P. G. Adsule and Dr. G. S. Karibasappa	Meeting of the Grape Growers' Federation of India.	13th June 2008	Convened by the Karnataka Grape Growers' Association at Kudalsangam, Bijapur
Dr. P. G. Adsule and Dr. J. Satisha	Meeting with the Vice Chancellor and his Faculty at S. D. Agricultural University, Gujarat.	20th and 21st June 2008	S. D. Agricultural University, Gujarat at Dantiwada
Dr. A. K. Sharma	'Interactive meeting on 'Post-harvest technology of horticultural crops'.	23-24th August 2008	Indian Institute of Horticultural Research at Bangalore
Dr. M. Mani and Dr. G. S. Karibasappa	A meeting of National Wine Board.	5th September 2008	Joint Secretary, Ministry of Food Processing Industry, Govt. of India at MITCON office in Pune
Dr. M. Mani and Dr. N. S. Kulkarni	Meeting on 'Grape Crop Insurance'	23rd July 2008	Department of Horticulture, Govt. of Maharashtra at Pune
Dr. P. G. Adsule Dr. M. Mani Dr. G. S. Karibasappa Dr. S. D. Sawant and Dr. J. Sharma	Group meeting of AICRP on Subtropical Fruits - Grapes	29th July-2nd August 2008	Central Institute of Subtropical Horticulture, Lucknow

Workshops

Name of the scientist	Title of meeting	Duration	Organizer and place
Dr. N. S. Kulkarni	International Workshop on "Integrated Pest Management (IPM)" in Grapes	26-30th May 2008	FICCI at Hotel Taj , Hyderabad
Dr. K. Banerjee	European Pesticide Residue Workshop (EPRW 2008).	31st May - 8th June 2008	Berlin, Germany
Dr. R. G. Somkuwar	Review Meeting of Mega Seed Project.	5th January 2009	New Delhi

Distinguished Visitors

- Dr. Pilippa David, Director International Agriculture Technology Centre, UK , and Professor Colin Dennis, Campdeni Chorleywood Food Research Association, UK visited the Institute on 7th April 2008.
- Shri B. A. Coutinho, Additional Secretary, DARE & Financial Advisor, ICAR visited NRC Grapes on 11th April 2008 and reviewed the progress of Plan and Non-Plan expenditure and other related matters.
- Dr. H. P. Singh, Dy. Director General (Hort.), ICAR, New Delhi visited the Institute on 27th April 2008 and had a meeting with the Director and Scientists to discuss about various research programmes at the Institute.
- Caizergues Pierre and Gaspar Desormont from France visited the Institute on 28th April 2008.
- Dr. G. C. Tewari, Assistant Director General (Edn), ICAR, New Delhi visited the Institute on 19th May 2008.
- Dr. R. V. S. Rao, Principal Scientist, CTRI, Rajahmundry visited the Institute on 23rd May 2008.
- Thirty-nine students along with 3 faculties from R.J. College, Mumbai visited the Institute on 19th August 2008.
- Visitors from Nasik visited the Institute on 28th August 2008 to know the latest technologies/ infrastructure generated by the Institute.
- Four grape growers from Bagalkot visited the Institute on 1st September 2008 to see the research plots and laboratories of the Institute.
- Dr. Mangala Rai, Secretary, DARE and Director General, ICAR visited the Institute on 15th December 2008.
- Dr. A.K. Upadhyay, Additional Secretary, DARE and Secretary, ICAR visited the Institute on 1st January 2009.
- The Chief General Manager, NABARD, Pune visited the Institute on 21st January 2009.
- A team of 38 progressive mushroom growers of Solan visited the Insitute on 7th February 2009.
- Mr. Barner and Mrs. Claire, representative of Ritcher Nursery Ltd., France visited the nursery of the Institute on 22nd February 2009.

Research and Management Personnel

DIRECTOR
Dr. P. G. Adsule

CROP IMPROVEMENT
Dr. G. S. Karibasappa, Principal Scientist (Horticulture)
Dr. Anuradha Upadhyay, Sr. Scientist (Biotechnology)

CROP PRODUCTION
Dr. R. G. Somkuwar, Senior Scientist (Horticulture)
Dr. A. K. Upadhyay, Senior Scientist (Soil Science)
Dr. S. D. Ramteke, Senior Scientist (Plant Physiology)
Dr. J. Sharma, Senior Scientist (Soil Science)
Dr. J. Satisha, Senior Scientist (Horticulture)

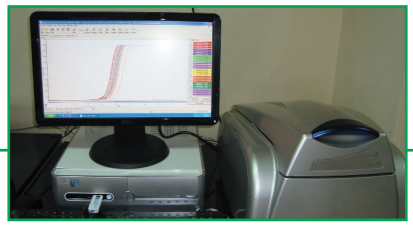
CROP PROTECTION
Dr. M. Mani, Principal Scientist (Entomology) - upto 22.01.2009
Dr. Indu. S. Sawant, Principal Scientist (Plant Pathology)
Dr. S. D. Sawant, Principal Scientist (Plant Pathology)
Dr. K. Banerjee, Senior Scientist (Agricultural Chemistry)
Dr. N. S. Kulkarni, Scientist SS (Entomology)

POST-HARVEST TECHNOLOGY
Dr. A. K. Sharma, Senior Scientist (Horticulture)

ARIS
Mrs. Kavita Y. Mundankar, Scientist Senior Scale (Computer Applications)

ADMINISTRATION & FINANCE
Mr. O. Babu, Assistant Administrative Officer
Mr. A. Srinivasamurthy, Assistant Finance and Accounts Officer

Infrastructure Development



Laboratory

During the period, equipments viz. Real Time PCR, Nanospectrophotometer, 80°C deep freezer were procured and commissioned in various laboratories of the Institute.

Library

During the year, following new accessions were added to the library:

Sl. No.	Item	Gift	Purchased	Total
1.	Books	4	57	61
2.	Scientific journals	7	183	190

New Structure

A raisin shed was constructed to conduct the experiment on grape processing.

Other Activities

हिंदी पखवाड़ा

केंद्र में १६ से ३० सितंबर २००८ तक हिंदी पखवाड़ा मनाया गया। कार्यक्रम का शुभारम्भ दि. १६ सितंबर को हिंदी में अधिकाधिक काम करने की शपथ के साथ हुआ। इस दौरान हिंदी निबंध, कविता पाठ, कंप्युटर पर हिंदी टंकण, वाद विवाद, प्रश्नोत्तरी, सुलेख व पत्र लेखन आदि प्रतियोगिताओं का आयोजन किया गया जिनमें संस्थान के सभी अधिकारियों और कर्मचारियों ने उत्साह पूर्वक भाग लिया। कार्यक्रम का समापन ३० सितंबर को हुआ। इस अवसर पर श्रीमती मालती शर्मा (वरिष्ठ हिंदी लेखिका) मुख्य अतिथि थीं।

पत्रव्यवहार

केन्द्र में प्राप्त हिन्दी पत्रों का उत्तर केवल हिन्दी में ही दिया जाता है। साथ ही कुछ पत्रों के उत्तर द्विभाषी भी होते है। इस वर्ष केन्द्र से ७७४ पत्र हिन्दी में प्रेषित किए गए।

तिमाही प्रतिवेदन तथा बैठक

केन्द्र में नियत समय पर परिषद के राजभाषा अनुभाग को तिमाही प्रतिवेदन प्रस्तुत किया गया। इस प्रतिवेदन में हिन्दी

में किये गए कार्यों की जानकारी दी गई। हिन्दी कार्यों की समीक्षा तथा हिन्दी के प्रयोग को रुचिकर बनाने के लिए नियत समय पर हिन्दी कार्यकारिणी की बैठक हुई। बैठक में प्राप्त निर्देशों पर साथ ही विचार किया गया।

Celebrations

स्वाधीनता दिवस

संस्थान में 15 अगस्त 2008 को स्वाधीनता दिवस हर्ष और उल्लास से मनाया गया। संस्थान के निदेशक डॉ. पां. गु. अडसुले ने ध्वजारोहण से कार्यक्रम का शुभारम्भ किया। अपने भाषण में देश की प्रगति में कृषि और किसानों के योगदान का अवलोकन किया और सभी अधिकारियों और कर्मचारियों को देश की उन्नति के लिए कार्य करने का आहवान किया। बोर्ड परीक्षा में उत्तम प्रदर्शन करने वाले कर्मचारियों के बच्चों को नकद पुरस्कार से सम्मानित किया।

वनमहोत्सव

संस्थान में 31 जुलाई को वनमहोत्सव का आयोजन किया गया। इस अवसर पर सामाजिक वन विभाग, महाराष्ट्र सरकार और एंजल हायस्कूल, लोनी कालभोर की सहायता से संस्थान परिसर में 1500 पौध लगाई गयी।

Tree plantation during vanmahotsav

Vigilance Week

Vigilance Week was observed from 3-7th November 2008 with the pledge by the staff on 3rd November 2008.

Republic Day

The Institute celebrated Republic Day on 26th January with joy and splendour. Dr. P. G. Adsule, Director, hoisted the flag. In his address, he highlighted the good work done by the Institute for improving grape sector in India and stressed upon the need to intensify our efforts to further strengthen it. Staff and their children sang patriotic song and sweets were distributed.

Foundation Stone Laying Ceremony of National Institute of Abiotic Stress Management, Baramati, Pune

Director, NRC for Grapes was assigned the duty of 'Nodal Officer' for organizing Foundation Stone Laying Ceremony of National Institute of Abiotic Stress Management, Baramati, Pune. The director and other staff of the Institute made all out efforts arrangements for the successful organization of the programme on 21st February 2009. The Director General has issued an appreciation letter to the Director and the team of officials of this institute for this function

Institute Committees

Various units and committees were formed to look after Research Management & Coordination, Technical Cell, Publication, Store Purchase, Farm Management, Library, Works, Photography, Sports activities, ARIS Cell, IRGS and Official Language Implementation.

Meteorological Data

Year & Month	Air temperature (°C)		Relative Humidity (%)		Pan evapo-ration (mm)	Sunshine duration (hr.)	Total rainfall (mm)	No. of rainy days	No. of rainy days with >4 mm rain
	Min.	Max.	Min.	Max.					
Apr 2008	18.3	38.5	21.1	85.8	6.9	11.6	1.2	4	0
May 2008	22.4	37.1	30.6	88.7	7.2	12.5	1.6	3	0
Jun 2008	22.7	31.1	64.1	96.8	3.3	12.1	45.4	17	3
Jul 2008	21.6	30.7	69.6	99.7	3.5	11.7	28.8	20	2
Aug 2008	20.9	30.4	73.4	100.0	2.3	10.9	78.6	23	4
Sep 2008	20.2	31.5	67.4	100.0	1.8	10.6	188.4	24	9
Oct 2008	16.3	32.6	44.9	100.0	3.5	10.9	23.8	10	3
Nov 2008	14.6	31.5	42.8	99.6	3.5	10.3	6.8	10	0
Dec 2008	12.4	31.0	42.2	99.9	2.9	9.9	39.0	10	1
Jan 2009	11.3	32.1	35.3	99.4	3.4	10.3	0.6	2	0
Feb 2009	11.8	35.3	24.9	92.4	5.1	10.8	0.0	0	0
Mar 2009	15.6	37.7	19.5	81.1	6.0	11.2	0.0	0	0
Total	—	—	—	—	—	132.8	414.2	123	22

Source : Weather station, NRC for Grapes, Pune
Days with >4 mm rains do not require irrigation.

Abbreviations

6BA	:	6 Benzyl Adenine
AICRP	:	All India Coordinated Research Project Centres
ANGRAU	:	Acharya N.G. Ranga Agricultural University
AOAC	:	Association of Official Analytical Chemist
APEDA	:	Processed Food Products Export Development Authority
ARIS	:	Agricultural Research Information System
ASEV	:	Australian Society of Enology and Viticulture
BARC	:	Bhabha Atomic Research Centre
BIS	:	Bureau of Indian Standards
BSKKV	:	Dr. Balasaheb Sawant Konkan Krishi Vidypeeth
CD	:	Critical Difference
CIB	:	Central Insecticide Bureau
CIRCOT	:	Central Institute for Research on Cotton Technology
CISH	:	Central Institute of Subtropical Horticulture
CPPU	:	N-(2-chloro-4-pyridyl)-N -phenyl urea
CTRI	:	Central Tobacco Research Institute
CV	:	Coefficient of Variability
DAP	:	Days after Pruning
DARE	:	Department of Agricultural Research and Education
DBT	:	Department of Biotechnology
DCH	:	Double Cordon Horizontal
DNA	:	Deoxyribo Nucleic Acid
DPC	:	Departmental Promotional Committee
EC	:	Electrical Conductivity
EPRW	:	European Pesticide Residue Workshop
FCD	:	Four Cordon Diagonal
FCH	:	Four Cordon Horizontal
FICCI	:	Federation of Indian Chambers of Commerce and Industry
FRAP	:	Ferric Iron Reducing Antioxidant Power
FRP	:	Fiberglass Reinforced Plastic
GA3	:	Gibberellic Acid
GCV	:	Genotypic Coefficient of Variation
GCxGC, 2-D	:	Two dimensional Gas Chromatography
GFkV	:	Grapevine Fleck Virus
GLRaV	:	Grape Leaf Roll Virus
GUI	:	Graphical User Interface
HTML	:	Hyper Text Markup Language
IARI	:	Indian Agricultural Research Institute
IBA	:	Indole Butyric Acid
ICAR	:	Indian Council of Agricultural Research
ICCVE	:	Continental Climate Viticulture and Enology
IIHR	:	Indian Institute of Horticultural Research
IMC	:	Institute Management Committee
IPM	:	Integrated Pest Management
IPR	:	Intellectual Property Right
IRC	:	Institute Research Committee
IRGS	:	Internal Revenue Generation Scheme
ITMU	:	Institute Technology Management Unit
LOD	:	Limit of Detections
LOQ	:	limit of quantifications
MIDC	:	Maharashtra Industrial Development Corporation
MITCON	:	Maharashtra Industrial & Technical Consultancy Organisation Ltd
MPKV	:	Mahatma Phule Krishi Vidyapeeth
MRDBS	:	Maharashtra State Grape Growers' Association
MRL	:	Maximum Residue Limit
NAA	:	Naphthalene Acetic Acid
NABARD	:	National Bank for Agriculture and Rural Development
NAU	:	Navsari Agricultural University
NIST	:	National Institute of Standards and Technology
NRL	:	National Referral Laboratory
OIV	:	International Organization of Vine and Wine
OLIC	:	Official Language Implementation Committee
PC	:	Principal Components
PCB	:	Polychlorinated Biphenyls
PCR	:	Polymerase Chain Reaction
PCV	:	Phenotypic Coefficient of Variation
PDI	:	Per cent Disease Index
PFA	:	Prevention of Food Adulteration
PHI	:	Post Harvest Interval
PHT	:	Post Harvest Technology
PME	:	Project Management and Evaluation
ppm	:	Parts per million
PT	:	Proficiency Testing
RAC	:	Research Advisory Committee
RH	:	Relative Humidity
RTI	:	Right To Information
S/N	:	Signal-to-noise ratio
SC	:	Soluble Concentrate
SCH	:	Horizontally Placed Cordon
SEM	:	Standard Error of Mean
TOF-MS	:	Time of Flight Mass Spectrometry
TSS	:	Total Soluble Solids
TTA	:	Total Tartaric Acid
WG	:	Wettable Granule
WP	:	Wettable Powder