वार्षिक प्रतिवेदन | Annual Report 2010-11

राष्ट्रीय अंगूर अनुसंधान केंद्र

(भारतीय कृषि अनुसंधान परिषद)

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Correct Citation :
Annual Report 2010-11
National Research Centre for Grapes
Manjri Farm P.O., Solapur Road
Pune - 412 307, India

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Cover Page :
Autumn Royal (Top) and Autumn Seedless (Bottom), varieties introduced from USA

Published by :
Dr. P. G. Adsule
Director, National Research Centre for Grapes, Pune - 412 307

Printed at : Flamingo Business Systems, Pune. Telefax : 020-24214636, flamingo.b.s@gmail.com

Contents

Preface

National Research Centre for Grapes, Pune was established in January 1997 to undertake mission-oriented research to address the issues related to grape production and processing in India. During last thirteen years, the institute has made tremendous progress in terms of infrastructure development, research output and technology dissemination. With a few rented rooms in the office of the Maharashtra Rajya Draksh Bagaitdar Sangh (MRDBS) in Manjri in the beginning, the institute now has a laboratory cum administrative building, separate buildings of biocontrol laboratory, National Referral Laboratory, farm office, raisin shed, three FRP houses and experimental vineyards spread over 14 ha. The institute has now world-class research infrastructure in terms of high tech instruments and tools. LC-MS/MS, GC-MS/MS-TOF, ICP-MS, genetic analyzer, real time PCR machine, IRGA, canopy analyzer, wine analyzer, AAS, multichannel autoanalyzer, programmable ELISA plate reader, programmable plant growth chamber and incubators, stereo microscopes of high magnification, different types of centrifuges are some of the high end equipments available for conducting basic and strategic research.

The institute is the site for National Active Grape Germplasm and has almost 425 grape accessions in its field germplasm collection. Such an excellent infrastructure has resulted in recognition of the Centre for postgraduate studies by Pune University, Pune and Shivaji University, Kolhapur besides other universities in the country and every year several students complete their six months project work at this Institute. A nursery with a three star rating from NHB provides true to type, genuine and disease-free planting material of promising rootstock and commercial table and wine grape varieties. Transfer of technology through regular field visits of scientists of the Institute and their participation in growers' seminars, in-house interaction, training programmes and information placed on website has increased the Institute's clear visibility and credibility among the growers and other stakeholders of grape industry. Successful implementation of APEDA funded Pesticide Residue Monitoring Plan for export grape has contributed substantially to the stature of the Institute.

Presently research is conducted under broad areas of crop improvement, crop production, crop protection and pre and post harvest technology. Besides 15 institutional research programmes, several externally funded projects are in progress. The Centre is also undertaking consulting and mandate related contractual research.

During this period, technical work of grape crop in All India Coordinated Research Project on Subtropical Fruits (Grapes) with Central Institute of Subtropical Horticulture (CISH), Lucknow was also supervised and work progress reports were sent to the Head Quarters Office.

Institute organized various training programmes at the campus and off the campus to transfer various techniques developed during the period and also participated in programmes organized by 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.

The undersigned and Dr. K. Banerjee Sr. Scientist participated in the European Pesticide Residue Workshop (EPRW 2010) in Strasbourg, France and 47th Florida Pesticide Workshop, Florida, USA and visited a few research and education institutions in Germany and USA. Dr. J. Satisha completed two years of research studies on deputation as Postdoctoral Research Associate at Institute for

Continental Climate Viticulture and Enology, University of Missouri, Columbia, USA. Drs. A. K. Upadhyay and K. Banerjee and three RA/SRFs participated in the training programme at Rikilt Institute of Food Safety at Wageningen in The Netherlands under the Residue Monitoring programme of APEDA.

Revenue of ₹ 42.45 Lakhs was generated against the target of ₹ 40.00 Lakhs through training, consultancy, contract research and services, sale of planting material and farm produce.

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 Secretary, DARE and Director General, ICAR Dr. S. Ayyappan during his visit to this Institute on 25th October 2010; and Dr. H. P. Singh, Dy. Director General (Hort.), ICAR. I also appreciate the efforts and help received from Dr. Anuradha Upadhyay and other scientific and technical staff in the timely preparation of this important document.

Place : Pune
Date : June 2011

(P. G. ADSULE)
Director

कार्यकारी सारांश

राष्ट्रीय अंगूर अनुसंधान केंद्र की स्थापना जनवरी 1997 में भारत में अंगूर उत्पादन तथा प्रसंस्करण से सम्बन्धित मुद्दों पर लक्ष्य आधारित अनुसंधान कार्य के लिए हुई।

वर्तमान में फसल सुधार, फसल उत्पादन, फसल संरक्षण एवं कटाई पश्चात प्रौद्योगिकी अनुसंधान के व्यापक क्षेत्र है। 15 संस्थानीय अनुसंधान कार्यक्रमों के अलावा अनेक बाह्य निधिबद्ध परियोजनाएं भी उन्नति पर हैं। केन्द्र में परामर्श सेवाएं और अधिदेश से सम्बन्धित अनुबन्धित अनुसंधान पर भी कार्य किया जा रहा हैं। विभिन्न क्षेत्रों में पिछले वर्ष हुई उपलब्धियों का सारांश निम्न है।

आनुवंशिक संसाधन और सुधार

देश के विभिन्न अनुसंधान संस्थानों से अंगूर की 32 प्रविष्ठियों को शामिल कर अंगूर जननद्रव्य संग्रह को संवृधित किया गया। प्रतिकूल मौसम परिस्थितियों में जननद्रव्य निष्पादन का मूल्यांकन किया गया और कई सहिष्णु प्रविष्ठियों की पहचान की गयी। केन्द्र में विकसित मदिरा और खाने योग्य सोलह संकर और चार मूलवृंत संकरों का मूल्यांकन किया गया।

25 माइक्रोसैटेलाइट प्राइमर द्वारा 112 प्रविष्ठियों का आण्विक विश्लेषण किया गया और 418 युग्मविकल्पी (एलील) का पता लगाया गया। 112 प्रविष्ठियों की समानता का अनुमान लगाकर उनमें आनुवंशिक सम्बन्ध स्थापित किया गया। किशमिश चर्नी, सेंटीनियल सीडलैस और किशमिश रोज़ाविस के क्लोन चुनावों का एएफएलपी चिह्नक द्वारा विश्लेषण किया गया। सेंटीनियल सीडलैस और उसके क्लोन मांजरी नवीन तथा किशमिश चर्नी तथा इस के क्लोन शरद सीडलैस, नाथ सीडलैस के लिए एएफएलपी चिह्नक की पहचान की गयी।

उत्पादन प्रौद्योगिकी

दृढ़ काष्ठ कलम द्वारा प्रजनन के लिए डॉगरिज मूलवृंत की मातृ लता में जिंक (10 ग्रा. प्रति पौधा) के अनुप्रयोग से शीघ्र अंकुर, उन्नत सफलता प्रतिशत और शाखा लम्बाई प्राप्त हुई। विभिन्न मूलवृन्तों के प्रजनन के लिए हारमोन आईबीए की मात्रा का मानकीकरण किया गया।

थॉमसन सीडलैस में कलम लगाने से 10 दिन पहले पत्ती निकालने से शीघ्र कलीस्फुटन, उच्च शाखा लम्बाई, शाखा व्यास, अन्तःग्रन्थि लम्बाई तथा बेहतर कलम सफलता प्राप्त हुई। स्ववृंत थॉमसन और 110 आर पर कलमित कली में पॉलीफीनोल ऑक्सिडेज क्रियाशीलता अधिक थी। अधिक पॉलीफीनोल ऑक्सिडेज क्रियाशीलता वाली बेलों में शीघ्र और एकसमान कली स्फुटन प्राप्त हुआ।

डॉगरिज और 110 आर पर कलम की गयी फॅन्टासी सीडलैस और मांजरी नवीन में मणि गुणों पर मूलवृंत के प्रभाव के आरंभिक प्रयोग किए गये। 110 आर के मुकाबले डॉगरिज पर कलमित लता पर अधिक मणि व्यास, मणि वजन एवं लम्बाई प्राप्त हुई जबकि 110 आर में अधिक कुल घुलनशील पदार्थ मिला।

वाई ट्रेलिस में मंडल पद्धति के विभिन्न आशोधनों में ताश-ए-गणेश की चार कॉर्डन वाली लताओं में अधिकतम गुच्छों की संख्या एवं उपज प्राप्त हुई। परन्तु उच्च गुच्छा वजन एक कॉर्डन वाली लताओं से प्राप्त हुई। बावर पद्धति में भी चार कॉर्डन वाली लताओं में अधिक गुच्छा संख्या और अधिक गुच्छा वजन दो कॉर्डन वाली लताओं में मिला। मणि व्यास और कुल घुलनशील पदार्थ के लिए विभिन्न मंडल संरचनाओं में कोई महत्वपूर्ण अंतर नही मिला।

कॅबरनेट सॉविग्नॉन में 100 कि. ग्रा./हे. की दर से पोटॅशियम ऑक्साईड के अनुप्रयोग से प्रति लता गुच्छा संख्या और उपज में महत्वपूर्ण वृद्धि हुई। इससे अधिक पोटाश मात्रा से उपज में कोई महत्वपूर्ण वृद्धि नहीं हुई।

लवणीय सिंचाई में डॉगरिज के मुकाबले 110 आर पर कलमित फॅन्टासी सीडलैस में अधिक गुच्छे मिले। डॉगरिज पर कलमित लताओं के पर्णवृंतों में सोडियम की मात्रा भी अधिक पाई गयी।

गांठ फुलाव विकार के लक्षण वाले गुच्छों के विभिन्न उत्तकों में पोषक विश्लेषण के आधार पर यह निष्कर्ष निकाला कि पोषकों की कमी इस विकार का कारण नहीं है। अंगूर की शुष्क पत्री और पर्णवृन्तों में पोटॅशियम और सोडियम के आंकलन के लिए एक सरल विधि जिसमें पानी को तत्व निकालने के लिए उपयोग किया गया, का विकास किया।

रेड ग्लोब में 3-4 एवं 6-7 मि.मी. अवस्था पर सीपीपीयू @ 1 पीपीएम और जिबरेलिक अम्ल @ 20-30 पीपीएम के प्रयोग से मणिगुणों में सुधार हुआ।

पादप स्वस्थ्य प्रबंधन

अंगूर बीमारियों के नियंत्रण क्षमता के लिए 25 अंत:पत्ती सूक्ष्मजीव आइसोलेट का परीक्षण किया गया और एंथ्रक्नोज, डाउनी और पाउडरी मिल्ड्यू के विरुद्ध प्रभावी आइसोलेट की पहचान की गयी।

फंफूदी नाशक फ्लुसीलाजोल के जैविक विघटन के लिए *ट्राइकोडर्मा* की विभिन्न प्रजातियों के 34 आइसोलेट का मूल्यांकन किया गया। 4 आइसोलेट द्वारा 15 दिन के भीतर इस फंफूदीनाशक का शत प्रतिशत विघटन हुआ।

थॉमसन सीडलैस में आधार छाँटनी के बाद असर्वांगी फंफूदीनाशक बॉर्डेक्स मिक्सर (0.5%) एवं मेंकोजेब (2 ग्रा./ली.) और वृद्धि विलंबकों के संयुक्त प्रयोग से डाउनी मिल्ड्यू का अच्छा नियंत्रण हुआ तथा इससे हाथ से शाखा निकालने के लिए श्रम लागत की बचत हुई। अग्रणी छाँटनी के बाद डाउनी मिल्ड्यू के नियंत्रण के लिए बहुस्थिति परीक्षण के आधार पर अनेक नई पीढ़ी फंफूदीनाशकों के लिए इष्टतम मात्रा निर्धारित की गयी। अन्त में फंफूदीनाशकों की अवशेष मात्रा न्यूनतम अवशेष सीमा से कम थी। पाउडरी मिल्ड्यू के नियंत्रण के लिए अनेक फंफूदीनाशकों की इष्टतम मात्रा निर्धारित की गयी। 12 विभिन्न स्थानों पर डाउनी मिल्ड्यू के नियंत्रण के लिए स्थान विशेष मौसम की भविष्यवाणी पर आधारित व्याधि प्रबंधन परामर्शी का सफलतापूर्वक उपयोग किया गया।

एलीसा और आरटी-पीसीआर द्वारा जीएलआरएवी-3 विषाणू के लक्षण विकास की निगरानी से पता चला कि पिनौ नॉयर किस्म में केवल परिपक्व पत्ती में ही विषापु के लक्षण विकसित होते है। थॉमसन सीडलैस एक लक्षणहीन वाहक बना रहा।

प्रजाति विशेष प्राइमर द्वारा आण्विक विश्लेषण से *कॉलेटोट्राइकम ग्लोस्पॉराइडिस* एवं *कॉलेटोट्राइकम केप्सीसि* को पत्तीचित्ती बिमारी के क्रमशः प्रमुख एवं गौण रोगजनक के रूप में पुष्टि की गयी। दोनों प्रजातियों की तास-ए-गणेश पर रोगजननक्षमता का परीक्षण किया गया। फंफूदीनाशक संवेदशीलता परीक्षण में दोनों प्रजातियां कारबेंडाजिम के मुकाबले फ्लुसिलाज़ोल और एजोक्सीस्ट्रॉबिन के प्रति संवेदनशील पाई गयी।

इस वर्ष महाराष्ट्र के विभिन्न क्षेत्रों में छटाई के बाद 90-110 दिन तक थ्रिप्स पर्याक्रमण के कारण फसल की क्षति देखी गयी। थ्रिप्स संख्या में बढ़ोतरी, आर्द्रता में कमी से मेल खाती पायी गयी। पिछले वर्ष के मुकाबले इस वर्ष मिलीबग पर्याक्रमण कम पाया गया। कुछ क्षेत्रों में लेडीबर्ड बीटल की दो प्रजातियां, जिसमें से एक प्रजाति *किलोमेनस सिक्समेकलेटी* की पहचान हुई, मिलीबग पर परभक्षी पायी गयी। लाल स्पाइडर माइट *टेट्रानिकस अरीटसी* का पर्याक्रमण महाराष्ट्र के सांगली, पंढरपूर और शोलापूर में अधिक परन्तु नासिक क्षेत्र में कम पाया गया। अधिक तापमान और वर्षा की कमी का माइट की अधिक जनसंख्या से सहसम्बन्ध पाया गया। तीन सम्भावित माइट परभक्षियों की पहचान कर आंकलन आरम्भ किया।

अनेक रसायनिक कीटनाशी और सूत्रण की क्षमता का परीक्षण किया गया। सोलह रसायन थ्रिप्स, 27 रसायन माइटस और 17 रसायन मिलीबग के नियंत्रण के लिए प्रभावी पाये गए। इन कीटनाशी की इष्टतम मात्रा निर्धारित की गयी।

एजोक्सिस्ट्रॉबिन की एकल और दो गुनी प्रयोग मात्रा के लिए कटाई पूर्व अन्तराल यूरोपियन युनियन के न्यूनतम अवशेष सीमा 2 मि.ग्रा./कि.ग्रा. के संदर्भ में क्रमशः 7 और 13 दिन आंका गया। ग्लाइफोसेट के अवशेष की मात्रा प्रयोग के दिन से तुड़ाई तक प्रमाणीकरण सीमा से कम पायी गई। विभिन्न समय पर अंगूर बागानों में क्लोरमेक्वेट क्लोराइड (सीसीसी) के क्षय की प्रक्रिया का अध्ययन किया गया। केवल उन बागानों में सीसीसी के अवशेष पाए गए, जहाँ दोनों छंटनी के बाद इस का छिड़काव किया गया था।

जल और जल आधारित पेय पदार्थों में कीटनाशी जैसी पीसीबी एवं पीएएच की नाममात्र अवशेष के निष्कर्षण के बाद जीसी-टॉफएमएस पर विश्लेषण के लिए एक आसान, कम लागत वाला और तीव्र तरीका विकसित कर उसकी पुष्टि की गयी। भारतीय मदिरा कारखानों से ली गयीं मदिरा नमूनों में संदूषकों के अवशेष नहीं पाए गए। मदिरा को खराब करने वाले पदार्थ 2,4,6 ट्राईक्लोरोएमीसोल के अवशेष विश्लेषण के लिए एक विधि का विकास किया गया।

विभिन्न प्रकार की मृदा में पेक्लोब्यूट्राज़ोल का अधिशोषण और क्षय का अध्ययन किया गया। मृदा द्वारा इस रसायन का भौतिक अधिशोषण पाया गया, हालांकि सभी मृदाओं में 30 दिन के भीतर पेक्लोब्यूट्राज़ोल का क्षय 0.05 मि.ग्रा./कि.ग्रा. से नीचे स्तर तक हो गया।

रेतीली मिट्टी में गलाइफोसेट का क्षय रेतीली - दूमर और चिकनी मिट्टी के मुकाबले शीघ्र हुआ। एक अन्य प्रयोग में पानी में इस शाक विनाशी का क्षय क्षारीय से मध्यस्थ पीएच में अम्लीय पीएच के मुकाबले तेजी से हुआ।

कटाई पश्चात प्रौद्योगिकी

कॅबरनेट सॉविग्नॉन और शिराज प्रजातियों में छंटनी समय गुच्छा भार ने मणि गुण जैसे मणि वजन, कुल घुलनशील पदार्थ (टीएसएस), एन्थोसाइनिन और कुल फीनोल को प्रभावित किया। ऐस्कोरबिक अम्ल @ 200 पीपीएम से पूर्व उपचार से किशमिश की रंग प्रबलता में कमी पायी गयी।

उच्च कोटि की पौध सामग्री का उत्पादन

इस वर्ष तकरीबन 3.65 लाख उच्च कोटि की पौध सामग्री जिसमें मूलवृंत, कलमित किस्में, स्वमूल किस्में एवं कलम का उत्पादन करके देश के विभिन्न राज्यों जैसे महाराष्ट्र, कर्नाटक, आंध्र प्रदेश, तमिलनाडु, उत्तर प्रदेश, जम्मू और कश्मीर, पंजाब और गुजरात में वितरित की गयीं।

प्रौद्योगिकी स्थानांतरण

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

मानव संसाधन विकास

वर्ष के दौरान, निदेशक और एक वैज्ञानिक ने फ्रांस में आयोजित यूरोपियन कीटनाशी अवशेष कार्यशाला (ईपीआरडब्ल्यू 2010), अमेरिका में आयोजित 47 वी फ्लोरिडा कीटनाशी कार्यशाला में भाग लिया और यूरोप तथा अमेरिका के विभिन्न अनुसंधान एवं शैक्षणिक संस्थानों का भ्रमण किया। एक वैज्ञानिक ने मिसौरी विश्वविद्यालय, कोलम्बिया, अमेरिका में दो वर्ष की प्रतिनियुक्ति पूरी की। अन्य दो वैज्ञानिक तथा तीन अनुसंधान सहायकों ने अवशेष प्रबोधन कार्यक्रम के अन्तर्गत रिकलिट इंस्टिट्यूट ऑफ फूड सेफ्टी, वेजिनिनजन, नीदरलँड में प्रशिक्षण लिया।

राजस्व आय

प्रशिक्षण परामर्श, अनुबन्ध अनुसंधान और सेवाएँ, पौध सामग्री और अंगूर विक्रय से इस वर्ष ४२.४५ लाख के राजस्व की प्राप्ति हुई।

Executive Summary

National Research Centre for Grapes, Pune was established in January 1997 to undertake mission-oriented research to address the issues related to grape production and processing in India.

Presently research is conducted under broad areas of crop improvement, crop production, crop protection and pre and post harvest technology. Besides 15 institutional research programmes, several externally funded projects are in progress. The Centre also undertakes consulting and mandate related contractual research. The achievements during last one year are summarized as below:

Genetic Resources and Improvement

The grape germplasm collection was augmented further by adding 32 more accessions from different research institutes. The germplasm was evaluated for their performance under unfavourable weather conditions. Sixteen promising hybrids and several tolerant accessions were identified for wine and table purpose and four rootstock hybrids developed at the Centre were evaluated for their performance.

112 accessions were analysed with 25 microsatellite primers. A total of 418 allele were detected. Similarity matrix among these accessions was estimated and genetic relationship was established. AFLP markers were used to analyse clonal selection of Kishmish Chernyi, Centennial Seedless and Kishmish Rozavis. Clone specific AFLP markers were identified for Manjri Naveen, a clone of Centennial Seedless. Similarly clones specific markers were identified for Sharad Seedless, Nath Seedless and Kishmish Chernyi.

Production Technology

Application of Zn @ 10 g/plant of mother vine resulted in early sprout, higher per cent success and shoot length during rootstock propagation using hard wood cutting. The dose of IBA treatment was standardised for the propagation of different rootstocks. In Thompson Seedless removal of leaf from canes 10 days before grafting resulted in early bud sprout, higher shoot length, shoot diameter and internodal length and uniform graft success.

In Thompson Seedless polyphenol oxidase (PPO) activity in buds was higher in own rooted and vines grafted on 110R as compared to vines on Dogridge. Early and uniform bud break was obtained in vines with higher PPO activity.

In a pilot study on influence of Dogridge and 110R rootstocks on fruit attributes of Fantasy Seedless and Manjri Naveen, more berry diameter, berry weight and berry length were obtained from vines grafted on Dogridge, however, more TSS was obtained in 110R.

Among different modifications in Y trellis training systems, the vines of Tas-A-Ganesh trained to four cordon had highest number of bunches and yield per vine however, higher single bunch weight was obtained from single cordon. Under bower system of training also, vines trained to four cordon yielded higher number of bunches, although the average bunch weight was higher in two cordon. The difference for berry diameter and TSS were non-significant. Among stem types double stem recorded higher yield than the single stem.

Application of K_2O @ 100 kg/ha resulted in significant increase in bunch number per vine and average yield in Cabernet Sauvignon. Higher doses did not increase the yield significantly.

In a comparative analysis under saline irrigation, vines of Fantasy Seedless grafted on 110R yielded more number of bunches as compared to Dogridge. Sodium content was also more in the petioles of vines grafted on Dogridge.

Based on the nutrient analysis of different tissues of bunches exhibiting swelling of knot, a disorder, the role of nutrient deficiency in this disorder was ruled out. A simple method where water is used as extractant was developed for the estimation of K and Na in the dried grape leaf and petioles.

In Red Globe, application of CPPU @ 1 ppm and GA_3 @ 20-30 ppm at 3-4 and 6-7 mm stage resulted in improved berry attributes.

Plant Health Management

Twenty-five endophytic bacterial isolates were tested for their ability to control grape diseases and several isolates effective against anthracnose, downy and powdery mildew were identified. Thirty-four isolates of *Trichoderma* spp. were evaluated *in vitro* for biodegradation of fungicide flusilazole and four isolates providing hundred per cent degradation were identified.

In Thompson Seedless after foundation pruning application of non-systemic fungicides Bordeaux mixture 0.5% and mancozeb 2g/L in combination with growth retardant resulted in good control of downy mildew thus reducing cost of labour needed for manual removal of shoots. Based on the multilocational trial for the control of downy mildew after forward pruning, effective doses of several new generation fungicides were estimated. The terminal residues of all these fungicides were below MRL. Similarly effective dose of several fungicidal formulations for the control of powdery mildew was determined. Location specific weather forecast based disease management advisory was successfully used for the management of downy mildew at 12 locations.

Monitoring of development of symptom for grapevine leaf roll associated virus-3 (GLRaV-3) by ELISA and RT-PCR indicated that symptoms for virus developed only in mature leaves in Pinot Noir, whereas Thompson Seedless remained symptomless carrier.

Molecular analysis with species specific primers confirmed *Colletotrichum gloeosporioides* as the major pathogen and *C. capsici* as the minor pathogen of leaf spot disease in grape. Both the species were tested for pathogenicity on Tas-A-Ganesh and Thompson Seedless. In fungicide sensitivity test pathogens were found to be more sensitive to flusilazole and azoxystrobin as compare to carbendazim.

This year damage due to thrips infestation up to 90-110 days after forward pruning was observed in different grape growing regions of Maharashtra. The build-up in thrips population coincided with decrease in humidity. Mealy bug infestation was lower than previous year. Two different species of lady bird beetle one of which identified as Cheilomenes sixmaclati were found predating on mealy bugs in some areas. Mite infestation due to red spider mite *Tetranychus urticae* was observed in pockets of Sangli, Pandharpur and Solapur area, while it was low in Nasik region. Population build up could be correlated with increased temperature and absence of rain. Three predators were found with possible association with mites, which are being evaluated.

Several different pesticides and formulation were tested for their efficacy. Sixteen chemicals were effective against thrips, 27 against mite and 17 were effective against mealy bugs. The optimum doses of these pesticides were estimated.

The preharvest interval (PHI) for azoxystrobin was estimated to be 7 and 13 days at single and double doses of application with respect to EU-MRL of 2 mg/kg. The concentration of glyphosate residues was found to be below limit of quantification on the day of application until harvest. Dissipation of Chlormequat chloride (CCC) was studied in vineyards with different timing of CCC application. The residues above EU-MRL limit were detected in only those plots where CCC was applied after both the foundation and forward pruning.

A simple, low cost and fast method was developed and validated for trace residue extraction of pesticide, dioxin like PCB and PAHs from water and water based samples followed by analysis through GC-TOFMS. Wine samples collected from Indian wineries were found to be free from contaminant residues. A method was developed for the residue analysis of wine spoilage compound 2,4,6 trichloroamisole.

Sorption and degradation of paclobutrazol was studied in different soil types. Physical adsorption of paclobutrazol on soil was recorded. However, in all soils paclobutrazol degraded to below 0.05 mg/kg within 30 days. The degradation of glyphosate was found to be faster in sandy soil followed by sandy loam and clay soil. In another experiment degradation of this herbicide in water was faster in alkali to neutral pH in comparison to acidic pH.

Post harvest Technology

Pruning time and bunch load affected the berry parameter like berry weight, TSS, TTS, anthocyanin and total phenols in Cabernet Sauvignon and Shiraz wine grape varities. Pretreatment of grapes with 200 ppm ascorbic acid resulted in reduced colour intensity in raisins.

Production of Quality Planting Material

Approximately 3.65 lakhs quality plant material comprising of rootstocks, grafted varieties, own rooted varieties and cuttings were distributed to various states of the country viz. Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, Jammu and Kashmir, Punjab and Gujarat.

Transfer of Technology

Transfer of technology and information on various aspects of viticulture and enology was 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. 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 benefited by training programmes organized by the Institute.

Human Resource Development

The Director and one scientist participated in the European Pesticide Residue Workshop (EPRW 2010) in Strasbourg, France and 47th Florida Pesticide Workshop, USA and visited several research and education institutions in Europe and USA. One scientist completed his two years deputation as Postdoctoral Research Associate at University of Missouri, Columbia, USA. Two scientists and three

RA/SRFs participated in the training programme at Rikilt Institute of Food Safety at Wageningen in The Netherlands under the Residue Monitoring programme of APEDA.

Revenue Generation

Revenue of ₹ 42.45 lakhs was generated through training, consultancy, contract research and services, sale of planting material and farm produce against a target of ₹ 40 lakhs.

परिचय/Introduction

राष्ट्रीय अंगूर अनुसंधान की स्थापना जनवरी 1997 में भारत में अंगूर उत्पादन तथा प्रसंस्करण से सम्बधित मुद्दों पर लक्ष्य आधारित अनुसंधान कार्य के लिए हुई। गत 14 वर्षो में संस्थान ने बुनियादी सुविधाओं के विकास, अनुसंधान तथा तकनीकी प्रसार के क्षेत्र में अद्‌भुत उन्नति की है। प्रारंभ में महाराष्ट्र द्राक्ष बागाईतदार संघ, मांजरी के कुछ किराये के कमरों में संस्थान कार्य आरम्भ हुआ परन्तु अब संस्थान के पास प्रयोगशाला एवं प्रशासनिक भवन के अलावा जैवनियंत्रण प्रयोगशाला, राष्ट्रीय संप्रेषण प्रयोगशाला, फार्म कार्यालय, किशमिश शैड, तीन पौली/एफ्आरपी हाउस एवं 35 एकड़ पर फैला प्रयोगात्मक अंगूर क्षेत्र है। संस्थान में मूल एवं सामरिक अनुसंधान के लिए आवश्यक अति आधुनिक बुनियादी सुविधायें और उपकरण जैसे एलसीएमएस/एमएस, जीसीएमएस/एमएम-टीओएफ, आईसीपी-एमएम/एमएस, जेनेटीक एनालाइजर, आरटी-पीसीआर मशीन, इरगा, वितान विश्लेषक, मदिरा विश्लेषक, एएएस, बहुचैनेल विश्लेषक, प्रोग्रामेबल एलिसा प्लेट रीडर, पादप वृद्धि कक्ष एवं इनक्यूबेटर, उच्चक्षमता की स्टीरियो सूक्ष्मदर्शी, विभिन्न क्षमताओं के अपकेन्द्रक उपलब्ध है। संस्थान स्थित राष्ट्रीय अंगूर जीन बैंक में 425 प्रविष्टियों का जननद्रव्य संग्रह है। उत्कृष्ट सुविधाओं के परिणामस्वरूप देश के अन्य विश्वविद्यालयों के अतिरिक्त पुणे विश्वविद्यालय, पुणे एवं शिवाजी विश्वविद्यालय, कोल्हापूर ने परास्नातक शिक्षा के लिए केन्द्र को मान्यता दी है तथा केन्द्र में प्रत्येक वर्ष अनेक छात्र अपनी 6 महीने की परियोजनाओं पर कार्य करते हैं। केन्द्र की पौधशाला, जिसे राष्ट्रीय बागवानी बोर्ड से तीन सितारा दर्जा हासिल है, मूलवृंत एवं खाने तथा मदिरा अंगूर की व्यावसायिक प्रजातियों की शुद्ध और असली पादप सामग्री उपलब्ध कराती है। नियमित क्षेत्रभ्रमण, उत्पादकों की सेमिनारों, अंगूर उत्पादकों के साथ चर्चा, प्रशिक्षण कार्यक्रमों तथा वेबसाइट पर उपलब्ध सूचना के द्वारा प्रौद्योगिकी स्थानांतरण के कारण उत्पादकों एवं अन्य अंगूर उद्योग के हितधारकों के बीच संस्थान की दृश्यता तथा विश्वसनीयता बढी है । एपिडा से वित्तप्रेषित अंगूर निर्यात के लिए कीटनाशक अवशेषों की निगरानी योजना के सफलतापूर्वक कार्यान्वयन ने संस्थान की महिमा में काफी योगदान किया है ।

केन्द्र में अनुसंधान कार्यक्रम भारतीय अंगूर उद्योग की आवश्यकताओं के मूल्यांकन के बाद बनाए जाते हैं तथा उन्हें समय-समय पर पंचवर्षीय समीक्षा टीम एवं अनुसंधान सलाहकार समिति की सिफारिश तथा अंगूर उद्योग के अन्य हितधारकों के अदानों के आधार पर परिवर्तित किया जाता है । वर्तमान में फसल सुधार, फसल उत्पादन, फसल संरक्षण तथा तुडाई उपरान्त प्रौद्योगिकी, अनुसंधान के व्यापक क्षेत्र हैं । 15 संस्थानीय अनुसंधान कार्यक्रमों के अलावा, कई बाह्य वित्त प्रेषित परियोजनायें चल रहीं हैं । केन्द्र में परामर्श सेवाएं एवं अधिदेश से सम्बधित अनुबन्ध अनुसंधान भी प्रगति पर है ।

अधिदेश

अंगूर के उत्पादन एवं उत्पादकता को प्रभावित करनेवाली जैविक एवं अजैविक बाधाओं के हल के लिए मूल एवं सामरिक अनुसंधान, उपज कायम रखना, मदिरा उत्पादन और अन्य मूल्यवृद्धि उत्पादों द्वारा विविधीकरण को बढावा और क्षेत्र विशेष तकनीकों का विकास एवं आंकलन ।

National Research Centre for Grapes, Pune was established in January 1997 to undertake mission-oriented research to address the issues related to grape production and processing in India. During last fourteen years, the institute has made tremendous progress in terms of infrastructure development, research output and technology dissemination. With a few rented rooms in the office of the Maharashtra Rajya Draksh Bagaitdar Sangh (MRDBS) in Manjri in the beginning, the institute now has a laboratory cum administrative building, separate buildings of biocontrol laboratory, National Referral Laboratory, farm office, raisin shed, three poly/FRP houses and experimental vineyards spread over 14 ha. The institute has now world-class research infrastructure in terms of high tech instruments and tools. LC-MS/MS, GC-MS/MS-TOF, ICP-MS, genetic analyzer, real time PCR machine, IRGA, canopy analyzer, wine analyzer, AAS, multichannel autoanalyzer, programmable ELISA plate reader, plant growth chamber and incubators, stereo microscopes of high magnification, different types of centrifuges are some of the high end equipments available for conducting basic and strategic research.

The institute is the site for National Grape Gene Bank and has almost 425 grape accessions in its field germplasm collection. Such an excellent infrastructure has resulted in recognition of the Centre for postgraduate studies by Pune University, Pune and Shivaji University, Kolhapur besides other universities in the country and every year several students complete their six months project work at this Institute. A nursery with a three star rating from NHB provides true to type and genuine and disease-free planting material of promising rootstock and commercial table and wine grape varieties. Transfer of technology through regular field visits of scientists of the Institute and their participation in growers' seminars, in house interaction, training programmes and information placed on website has increased the Institute's clear visibility and credibility among the growers and other stakeholders of grape industry. Successful implementation of APEDA funded Pesticide Residue Monitoring Plan for export grape has contributed substantially to the stature of the Institute

The research programmes are formulated after assessing the needs of grape industry in India and modified time to time based on the recommendation of QRT, RAC, and inputs from other grape industry stake-holders.

Presently research is conducted under broad areas of crop improvement, crop production, crop protection and pre and post harvest technology. Besides 15 institutional research programmes, several externally funded projects are in progress. The Centre also undertakes consulting and mandate related contractual research.

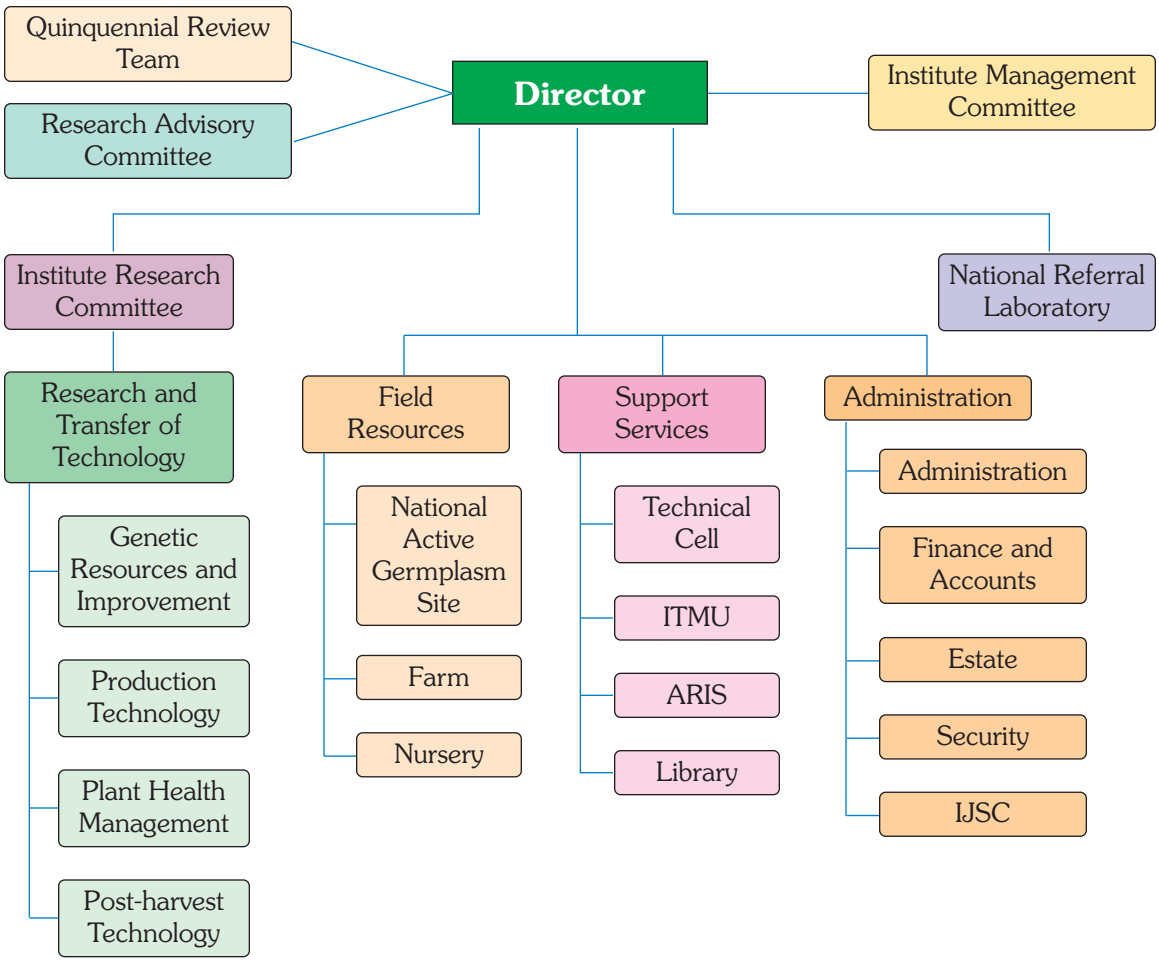
Mandate

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.

Organizational set-up



Financial statement

(Rs. in Lakhs)

Sl. No.	Heads	R.E. 2010-11		Expenditure 2010-11		Final Grant		Revenue Generated
		Plan	Non-Plan	Plan	Non-Plan	Plan	Non-Plan	
1.	Estt. Charges	7.50	220.00	7.50	220.00	7.50	220.00	
2.	O.T.A.	0.00	0.00	0.00	0.00	0.00	0.00	
3.	T.A.	5.00	1.20	5.00	1.20	5.00	1.20	
4.	Equipments	125.50	20.00	125.50	20.00	125.50	20.00	
5.	Library books	4.50	0.00	4.50	0.00	4.50	0.00	
6.	Other charges	96.00	86.00	96.00	86.00	96.00	86.00	
7.	Works	60.00	7.50	60.00	7.50	60.00	7.50	
8.	Furniture	1.50	0.00	1.50	0.00	1.50	0.00	
9.	Pension	0.00	12.30	0.00	12.30	0.00	12.30	
	Total	**300.00**	**347.00**	**300.00**	**347.00**	**300.00**	**347.00**	**42.45***

* Revenue of ₹ 42.45 lakhs was generated against the target of ₹ 40.00 lakhs through training, consultancy, contract research and services, sale of planting material and farm produce. Interest on term deposit receipts of ₹ 13.79 Lakhs was earned apart from the revenue receipts during 2010-11.

Staff position

Sl. No.	Post	Number of posts		
		Sanctioned	Filled	Vacant
1.	Research & Management Personnel	1	1	0
2.	Scientific	16	16	0
3.	Technical	8	8	0
4.	Administrative	12	9	3
5.	Supportive	7	7	0
	Total	**44**	**41**	**3**

Research Achievements

Genetic Resources and Improvement

Collection and augmentation of grape germplasm

The following 32 accessions were augmented to germplasm from different sources from India and abroad during this year. Accessions were obtained from IARI, New Delhi (*V. flexousa* var. *parviflora*, BA x Victory); ARI, Pune (James (*V. rotundifolia*), *V. palmata*, *V. berlandieri*, H- 324 (Gulabi x James), H144 (Cheema Sahebi x Catawba), H-768 (Gulabi x *V. candicans*), H-772 (Gulabi x *V. candicans*), H-778 (Gulabi x *V. candicans*), H-931 (Gulabi x *V. candicans*), H-422 (Champanel x Gulabi), H-452 (Champanel x Cheema Sahebi), H-1147 (Champanel x Bhokri), *Cayratia carnosa*); IIHR, Bangalore (Selection 1 (12/9), Selection 2 (4/74), H25/11, H29/6, H12/3, H6/2, H16/11, H1099, H1048, H911, H828, H1060, H797) and USA (Autumn Seedless (EC674321), Autumn Royal (EC 675644), Blush Seedless (EC674322), Merquise (EC674323)).

Germplasm evaluation

Pune experienced unprecedented rains in the month of November – December 2010. The grapevine varieties were affected by downy mildew (sustained infection), flower rotting, defoliation and anthracnose due to wet weather conditions. However, a few accessions, which were pruned during late October 2010, performed well even under such adverse weather conditions (Table 1).

Evaluation of introduced varieties

Four new hybrid seedless table grape varieties were introduced from USA at MRDBS experimental farm. These varieties were evaluated for their bunch characters (Table 2).

Development of new grape hybrids at NRCG

The performance of sixteen promising hybrids developed at the Centre was evaluated for their bunch characteristics (Table 3).

Development of new grape rootstocks

The female parent Teleki 5 BB (*V. berlandieri* x *V. riparia*) was crossed with male parents such as St. George (*V. rupestris*), 1103P (*V. berlandieri* x *V. rupestris*) and SO-4 (*V. berlandieri* x *V. riparia*). Among the 70 hybrid progeny only 4 hybrids were chosen for further studies and compared with their respective parents under polyhouse conditions (Table 4).

Molecular characterization and creation of molecular database of grape germplasm in India

112 accessions were analysed with 25 microsatellite primers. A total of 418 alleles were detected. The number of allele detected by each primer ranged from 9 to 25. The polymorphic information content for these primers ranged between 0.55-0.88. With this, we have completed molecular characterisation of 315 grape accessions. These include all the rootstocks available at the Centre, indigenous material collected from Himachal Pradesh, hybrids developed in India (IIHR, IARI), hybrids raised at the NRCG and at different stages of evaluation, wine varieties received from France, all the commercially important table, raisin and wine varieties, clonal selections of Thompson Seedless, clones of Sharad

Table 1. Performance of different grape accessions under adverse weather conditions

Performance	Accession
Healthy vines, clusters less affected (<10%) (74 Accessions)	PS-II-2, Frumaosa Alba, Cabernet Franc cl.312, E26/5, Muscat of Alexandria, E5/4, Queen of Vineyards, Ceffer, Tannat, Large White, Arka Hans, Bangalore Purple, Amber Sweet, Buckland Sweet Water, Rose Ciotet, B10-19-24, Arki A-2, *V. labrusca*, PS-III-12-3, Carolina Black Rose, F-26-8, Goethe, Lake Emerald, Malvasia Bianca, Malagha, Fruhroter Veltliner, E2/7, SV-23501, SV-12309, SV-12364, Seibel-9308, Tigvosa, EC 27818, Coarna Alba, Jaffayam, G102/1, Pierce, Kyohou, Tensau, Chenin Blanc, Shiraz, CharArk-2, Choultu Red, Bianca, Sirius, Doradillo, Champion, Red Globe, A18-3, E12/2, Red Prince, Marroo Seedless, Grenache Blanc, E29/3, Medika, A27-5, A34-3, Cabernet Sauvignon, Semillon, Ugni Blanc, Concord, Trebbiano, Catawba, Pusa Navrang, Clairette, Maurvedre, Grenache, Bangalore Blue, H-27, PN x RG, Rizamat, Sekerie, Rosaria Bianca and Madhu Angur.
Healthy vines and clusters affected moderately (11-20%) (42 Accessions)	Gulabi, H-87, Fakri, E4/15, SV-12375, Gulabi x Fakri, Sauvignon Blanc, Pusa Urvashi, Coarna Regia, Black Madelien, Neagra Vertis, Muscat, Olympia, Julesky Muscat, Red Ficvoasa, Red Nihalson, Black Olympia, Champak, Moldowsky, B46-2, Kinnauri-2, PS-III-11-4, SV18402, Ribier, Gulabi (Theni), Benzuhio, Grasa-de-Cotenoir, Korean Italia, Tsimlanski Chernyi, Omania Black, Fantasy Seedless, Crimson Seedless, Kishmish Luchisty, Amber Queen, Golden Queen, Barbarossa, Black Damas Rose, Convent Large Black, Italian Eliquena, A14-3, Manjri Naveen, Arka Shyam.
Healthy vines but clusters heavily affected (21-40%)	E6/2, Kishmish Rozavis White, Dilkush, Muscat Hamburg (K), Kishmish Rozavis, Thompson Seedless, Tas-A-Ganesh, Flame Seedless, Anab-e-Shahi, Arka Kanchan, Centennial Seedless, A20-31-37, Athens.
Diseased vines and clusters heavily affected (>80%)	Pearl of Csaba, Black Monukka, Superior Seedless, Sharad Seedless, Krishna Seedless, Ruby Seedless, Black Prince, Christmas Rose, Flame Seedless, Beauty Seedless.

Table 2. Bunch characteristics of introduced varieties

Variety name and age of vine	No.of bunches/ vine	Bunch weight (g)	Berry weight (g)	TSS (%)	Acidity (%)	Remarks
Blush Seedless, 3 years	27.0	140.0	2.30	19.00	0.65	Red, seedless, medium late, uniform ripening, good keeping quality.
Autumn Royal, 3 years	16.0	450.0	8.90	19.00	0.56	Black, seedless, late maturing, natural bold berries, good keeping quality.
Merquise, 3 years	22.0	185.0	3.80	20.00	0.35	White, seedless, medium early, disease tolerant, foxy flavoured, good keeping quality.
Autumn Seedless, 3 years	18.0	265.0	3.90	21.00	0.65	White, seedless, medium maturing, oval shape berry, good keeping quality.

Table 3. Evaluation of bunch qualities of promising grape hybrids / selections and their parents

Sl. no.	Genotype/ Cross/ hybrid	Bunch weight (g)	Berry weight (g)	Berry diameter (mm)	TSS (°B)	Acidity (%)	Seed no. and seed weight (10 berries)	Important characteristics
Table, raisin / munakka								
1.	A4-7-12 (Thompson Seedless x Catawba)	145	2.40	15.8	18.6	0.56	13 (0.43)	White, early, disease tolerant, table grape
2	A3-7-12 (Thompson Seedless x Catawba)	160	2.65	16.0	17.0	0.52	17 (0.52)	White, early, disease tolerant, table grape
3.	Manjri Naveen (a selection from Centennial Seedless)	325	4.70	18.2	17.6	0.48	–	Early, white, seedless, table grape
4.	AH4-23 (Rangspey x Perlette)	165	2.30	15.4	23.4	0.38	14 (0.17)	Early, white with rudimentary seeds, table grape
5.	AH1-23 (Pusa Navrang x Red Globe)	180	3.40	16.6	22.0	0.66	15 (1.00)	Early, teinturier red, table grape
6.	AH2-36 (Spin Sahebi x Italia Eliquena)	310	6.40	21.2	20.0	0.43	11 (0.51)	Mid-late, purple black, bold seeded, table grape / munakka
7.	AH2-23 (Spin Sahebi x Sahebi Ali)	370	5.50	19.6	22.2	0.40	20 (1.09)	Mid-late, white, seeded and bold berries, table grape
8.	AH2-20 (Spin Sahebi x Kishmish Chernyi)	175	2.40	14.8	19.8	0.51	15 (0.11)	Early black, seedless, table grape
9.	AH2-22 (Spin Sahebi x Thompson Seedless)	260	3.20	17.2	19.0	0.52	11 (0.12)	Mid-late, consistent yielder, table grape
10.	AH4-15 (Rangspey x Thompson Seedless)	220	2.90	16.0	19.0	0.55	12 (0.28)	White, mid-late, table grape / raisin
11.	AH2-8 (Spin Sahebi x Black Monukka)	220	2.40	15.6	20.6	0.67	–	Seedless, canopy uniform, vines are productive, black, table grape
12.	AH3-6 (Spin Sahebi x Sahebi Ali)	210	4.20	18.2	19.8	0.45	29 (1.16)	Bright, bold attractive bunches and seeded berries, munakka
13.	AH2-5 (Spin Sahebi x Jaos Belyi)	490	8.90	23.0	18.0	0.40	26 (1.60)	White seeded, big bunches and bold berries, table grape / munakka

Sl. no.	Genotype/ Cross/ hybrid	Bunch weight (g)	Berry weight (g)	Berry diameter (mm)	TSS (°B)	Acidity (%)	Seed no. and seed weight (10 berries)	Important characteristics
14.	AH2-4 (Spin Sahebi x Superior Seedless)	350	3.90	17.2	18.6	0.48	12 (0.17)	Mid-late ripening, white with rudimentary seeds, table grape
Wine / juice								
15.	AH4-34 (Chardonnay x Arkavati)	125	1.67	14.0	24.0	0.52	18 (0.24)	Mid-late, moderate yielder, wine grape
16.	B52-1 (Pusa Navrang x Red Globe)	210	3.20	16.4	22.0	0.62	22 (0.89)	Teinturier, vines are productive, good keeping quality, juice / processing
Parents used in hybridization								
1.	Thompson Seedless	295	2.40	15.2	23.0	0.58	0.0	Late ripening, table grape / raisin
2.	Catawba	120	1.80	14.2	18.0	0.63	24 (1.97)	Coloured, late ripening, labrusca type, table grape / juice
3.	Italian Eliquena	255	3.96	17.4	18.6	0.52	22 (1.43)	Black, seeded, naturally bold, pleasant flavour, good keeping quality, table grape
4.	Spin Sahebi	245	3.40	18.1	23.0	0.48	23 (1.96)	Male sterile, mid late, table grape
5.	Pusa Navrang	140	1.80	14.2	18.0	0.88	23 (1.17)	Teinturier, juicy type, tolerant to anthracnose, early maturing
6.	Red Globe	600	8.96	23.2	17.6	0.52	28 (1.43)	Red seeded , naturally bold, neutral flavour, good keeping quality
7.	Flame Seedless	285	2.40	15.8	17.8	0.50	–	Vigorous, productive, early ripening, Muscat flavour, crisp pulp, poor keeping quality
8.	Black Monukka	175	1.90	15.0	22.0	0.46	–	Moderate yielder, purple seedless, medium late ripening, small berries, susceptible to berry drop

Sl. no.	Genotype/ Cross/ hybrid	Bunch weight (g)	Berry weight (g)	Berry diameter (mm)	TSS (°B)	Acidity (%)	Seed no. and seed weight (10 berries)	Important characteristics
9.	Perlette	255	1.96	14.9	21.0	0.40	–	Good yielder, early ripening on spur pruning, tight clusters, berries juicy, poor keeping quality
10.	Superior Seedless	340	4.60	18.2	19.4	0.39	–	Vines vigorous, bearing not consistent, fruit qualities excellent with Muscat flavour, mid early ripening
11.	Rangspey	280	2.40	15.4	18.6	0.59	28 (1.94)	White seeded, tolerant to powdery mildew, loose bunch, late ripening
12.	Jaos Belyi	310	3.60	17.2	19.0	0.57	18 (1.60)	White seeded, bold but juicy berries
13.	Arkavati	160	1.90	14.8	19.4	0.52	18 (0.30)	White with rudimentary seeds, loose cylindrical bunches, late ripening
14.	Chardonnay	128	1.50	13.8	22.0	0.58	24 (1.10)	Poor yielding, clusters small, late ripening
15.	Kishmish Chernyi	170	1.80	15.2	23.0	0.49	–	Black seedless, canopy vigorous, requires berry thinning for better fruit size. Vines are highly productive, mid early ripening
16.	Sahebi Ali	240	3.70	18.6	22.0	0.54	18 (1.70)	White seeded, bright, attractive berries, oval to elliptic in shape, loose clusters, late maturing

Table 4. Evaluation of rootstock hybrids

Sl. No.	Hybrid rootstock / parent	Percentage establishment	Remarks
1.	110 Richter cl.180 (Check)	76	Slightly affected by Cl toxicity, low vigor
2.	Teleki 5BB	59	Vigorous and spreading type
3.	SO4	64	Vigorous, upright growth
4.	St. George	68	Less vigorous, affected by Cl toxicity
5.	1103P	66	Vigorous, upright growth
6.	B66-2 (Teleki 5BB x St. George)	72	Moderate vigour, slightly affected by Cl toxicity
7.	B66-4 (Teleki 5BB x St. George)	79	More vigorous than B66-2, and less affected by Cl toxicity
8.	B64-8 (Teleki 5BB x 1103P)	92	Vigorous and least affected by Cl toxicity
9.	B69 (Teleki 5BB x SO4)	84	Vigorous slightly affected by Cl toxicity

Seedless collected from farmers' field and clones of Kishmish Rozavis and Centennial Seedless identified at the Centre.

The allele data was used to calculate similarity coefficients and subsequently genetic relationships among different accessions was established. Figure 1 illustrates grouping of 112 accessions based on Principal Coordinate Analysis (PCA).

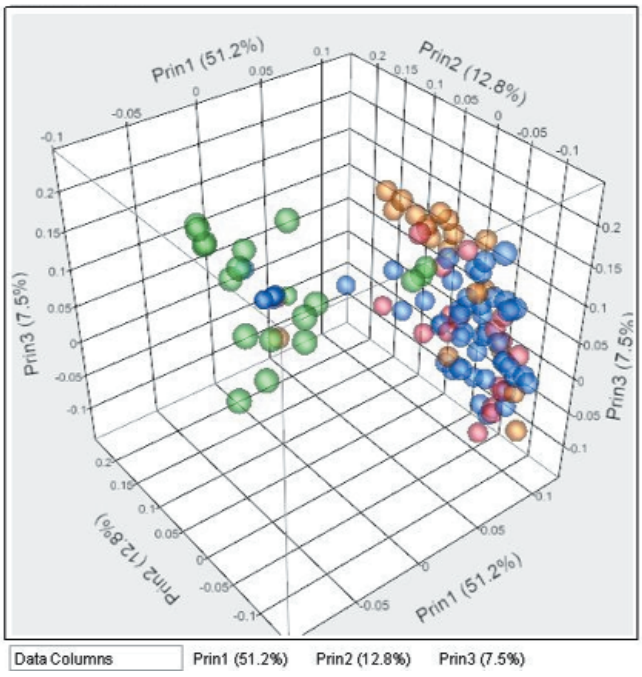


Fig. 1. PCA of microsatellite data of 112 accessions.

AFLP markers were used to analyse clonal selections of Kishmish Chernyi, Centennial Seedless and Kishmish Rozavis. AFLP analysis of Manjri Naveen, a clone of Centennial Seedless with 42 primer pairs identified clone specific AFLP fragment. Kishmish Rozavis White, a clonal selection of Kishmish Rozavis, which has been found to be useful for raisin making, was analysed with 40 AFLP primer combinations. A total of 1750 band were detected, however no polymorphic band was detected. Clones of Kishmish Chernyi were analysed with 24 more AFLP primer combinations. Polymorphic AFLP bands were obtained only for Sharad Seedless, Nath Seedless and Kishmish Chernyi, whereas Sarita Seedless and Krishna Seedless could not be distinguished at molecular level. The molecular data obtained through SSR analysis was entered in the database.

Observations were recorded on morphological traits of different accessions after forward pruning which will be used for association analysis.

Production Technology

Effect of zinc on rooting success through hardwood cuttings

Micronutrients especially zinc in the cuttings is considered as auxin activator that helps in early sprouting of cuttings. Grape rootstocks are propagated mainly through hardwood cuttings. One season old matured cuttings with appropriate shoot thickness are harvested from the mother vine. The storage available in the mother vine helps in early sprout and establishment of the rooted plants in the nursery.

Zinc was applied to the mother vines of Dogridge in different doses of 5, 10, 15 and 20 g/plant two months before harvest of cuttings ready for propagation. The observations were recorded on number of days taken for bud sprout, percent success, shoot diameter and shoot length along with the nutrient status of the rooted plants. The results indicated that application of zinc @ 10 g/plant of mother vine resulted into early sprout, higher percent success and vine shoot length as compared to other treatments. The status of other major and micro nutrients showed that higher amount of zinc was available in the same treatment.

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

Multiplication of rootstock is being carried out by hardwood cuttings. An experiment was thus conducted to standardize the IBA concentration for multiplication of different rootstocks viz. Dogridge, St. George, Freedom, 1613C and 140 RU.

These rootstocks were treated with the different IBA concentration of 750, 1000, 1500 and 2000 ppm and were compared with control. Dogridge rootstock was found to be early to sprout as compared to all other rootstocks. Significant differences were recorded for shoot length. Freedom rootstock imparted more shoot length at 750 ppm IBA concentration followed by St. George in 1500 ppm as compared to the control in all rootstocks. Higher leaf area was recorded in 1613C rootstock followed by Freedom and 140 RU. The study indicated that different rootstocks require different IBA concentration for multiplication through hardwood cuttings. This was confirmation of last year results.

Effect of leaf removal on grafting success in Thompson Seedless grapes

Leaf removal from the canes of mother vine was carried out at 12, 10, 8, 6 days before grafting and was compared with non-removal of leaves.

Significant differences were recorded among the different treatments of leaf removal. Bud sprouting was early when leaves were removed 10 days before grafting followed by 8 days and 6 days respectively. The sprouting was delayed in canes where the leaf was not removed before grafting. The shoot length, shoot diameter, internodal length and stock: scion was higher since the bud sprouting was early in the same treatment. Therefore, removal of leaf at 6 to 10 days before grafting is essential for successful grafting.

An investigation into basic mechanisms of grape rootstocks on commercially important viticulture traits in table grapevines

Thompson Seedless grown on different rootstocks were analysed for different biochemical parameters at different stages of growth. Fruit composition data revealed no significant differences in most of the fruit composition parameters except for juice acidity and sodium content. Highest acidity (0.606 %) was recorded on own rooted vines while 1103 P recorded lowest acidity (0.535 %) which was on par with that of 110 R and 99 R rootstocks. Regarding fruit size in terms of berry diameter, maximum berry diameter of 16.8 mm was recorded on Dogridge followed by those on 110R (16.33 mm). The least berry diameter was recorded on own rooted vines (14.53 mm).

Polyphenol oxidase (PPO) activity was estimated in the buds at the time of bud burst after forward pruning. Higher PPO activity was recorded in own rooted Thompson Seedless (2.65 EU/mL/min) and those grafted on 110R (2.38 EU/mL/min), St. George (2.30 EU/mL/min) as compared to those grafted on Dogridge (1.68 EU/mL/min). The increased PPO activity in own rooted and 110 R rootstock might have induced quick and uniform bud sprout in own rooted and 110 R rootstocks (12-14 days) while bud sprouting was late on Dogridge rootstocks (22 days).

No significant difference in total protein content was observed on different rootstocks at different stages of berry development. But gradual reduction in total protein content was recorded from fruit set till harvest which may be attributed to breakdown of proteins into amino acids. LC-MS/MS analysis of amino acid profiles at different stages of berry development revealed similar pattern of amino acid accumulation on all the rootstocks, but the stage at which a particular amino acid reaches maximum varied with the rootstocks.

Total amino acid content increased from fruit set till ripening in all the rootstock - scion combinations. The total amino acid content varied from 49.50 to 67.78 (mg/kg) at the time of fruit set to 536 -798 mg/kg at harvest stage. Arginine and proline were the predominant amino acids. The arginine content increased gradually from fruit set till veraison and subsequently reduced till harvest. But, the sudden increase in proline content was observed at the time of veraison and its concentration increased till the time of harvesting. Gradual reduction in total phenolic content was recorded on all the rootstocks from fruit set (198 – 276 mg/g) to harvest (72-134 mg/g).

Influence of rootstocks on fruit composition of Fantasy Seedless and Manjri Naveen grape cultivars

A pilot scale study was conducted to study the influence of two important grape rootstocks Dogridge and 110 R on fruit characters and composition of two commercially important cultivars Fantasy Seedless and Manjri Naveen in a farmer's field at Pune. Fruit samples were collected at the time of harvest and analysed for fruit characters and composition.

The fruit composition data is shown in Table 5. In both the cultivars, berry size in terms of berry weight, berry diameter and berry length was more on Dogridge rootstock than on 110 R. Total soluble solid was higher on 110 R as compared to Dogridge. Not much difference was recorded for total acidity though difference was recorded among varieties with more acidity in Fantasy Seedless than in Manjri Naveen.

Total amino acid content in both the varieties was higher in vines grafted on Dogridge than on 110 R. Arginine and Proline were the predominant amino acids in both the cultivars.

Table 5. Influence of rootstocks on fruit composition of Fantasy Seedless and Manjri Naveen

Rootstock / Variety	50 berry weight (g)	Berry diameter (mm)	Berry length (mm)	TSS (°B)	Juice pH	Acidity (%)	Total amino acids (mg/kg)	Proline (mg/kg)	Arginine (mg/kg)
Rootstocks									
110 R	196.28	16.70	23.37	20.77	3.61	0.626	544.65	99.22	281.63
Dogridge	224.50	18.32	25.12	19.45	3.66	0.635	660.89	115.37	346.35
Significance	*	*	*	*	NS	NS	*	*	NS
Varieties									
FS	230.42	18.08	24.02	20.02	3.70	0.68	705.93	177.1	372.67
MN	190.35	16.24	24.48	20.09	3.57	0.57	499.56	37.58	255.31
Significance	*	*	NS	NS	*	*	*	*	*
Interaction									
110 R FS	223.04	18.30	23.02	21.07	3.72	0.678	637.41	164.88	334.51
110 R MN	169.42	15.70	23.72	20.47	3.52	0.571	451.89	33.56	228.76
Dogridge FS	237.71	17.87	25.04	19.20	3.70	0.685	724.50	189.13	410.83
Dogridge MN	211.28	16.78	25.24	19.71	3.62	0.584	574.29	41.60	281.87
Significance	*	*	NS	NS	NS	NS	NS	NS	NS

FS: Fantasy Seedless, MN: Manjri Naveen, *: Significance at $P<0.05$

Influence of canopy management practices on fruit composition of red and white wine grape cultivars grafted on 110 R rootstock

A preliminary study was conducted to know the influence of canopy management practices viz. shoot thinning and leaf removal either singly or in combination on fruit composition of two commercially important wine grape cultivars Cabernet Sauvignon and Sauvignon Blanc grafted on 110 R rootstock. Canopy management treatments were imposed on the vines at the time of fruit set. Untreated vines served as control treatment.

Fruit composition data (Table 6) clearly revealed reduced berry weight in vines which received leaf removal and shoot thinning (LR+ST) treatments compared to leaf removal (LR), shoot thinning (ST) and control vines. However, total soluble solid (TSS) content was highest on LR+ST treated vines. Acidity was maximum in control vines and minimum in vines which received LR+ST treatment. The vine which received the combined treatment of LR+ST also recorded reduced juice potassium content in both the cultivars. In Cabernet Sauvignon, LR+ST treatment induced higher accumulation of anthocyanin followed by that on LR treatment, while least anthocyanin was recorded in control vines.

Total amino acid content in Cabernet Sauvignon was maximum in LR+ST treated vines, whereas it was maximum in LR treated vines in Sauvignon Blanc.

Table 6. Influence of canopy management practices on fruit composition of wine grapes grafted on 110 R rootstocks

Variety/ treatment	100 berry weight (g)	TSS (°B)	Acidity (%)	Juice pH	K (%)	Total phenols (mg/g)	Proteins (mg/g)	Antho-cyanins (mg/g)	Amino Acids (mg/kg)
Varieties									
CS	90.00	22.36	0.85	3.39	0.139	6.09	282.12	2.13	718.44
SB	129.31	23.38	0.96	3.17	0.171	4.03	206.56	0.00	947.13
Significance	*	*	*	*	*	*	*	*	*
Treatments									
LR	114.75	22.80	0.90	3.30	0.141	5.74	247.47	1.10	941.23
ST	107.87	22.60	0.92	3.31	0.147	4.82	211.90	0.94	799.43
LR+ST	97.50	24.52	0.81	3.23	0.138	5.94	261.51	1.26	838.29
Control	108.50	21.57	1.00	3.39	0.198	3.74	256.53	0.95	752.21
Significance	*	*	*	NS	*	*	NS	NS	*

*: Significance at $P < 0.05$

SB : Sauvignon Blanc; CS : Cabernet Sauvignon; LR : Leaf Removal; ST : Shoot thinning

Source : Sink in relation to different canopy architecture in Tas-A-Ganesh grapes

Effect of plant type on growth and yield parameters

During foundation pruning, all the recommended cultural practices were followed to maintain the vine in good health. The canes were developed by making sub-cane system (pinching at 7-leaf). Forward pruning was done after assessing the bud position by testing the canes under microscope for fruit bud differentiation. Under different training modifications, vegetative growth, yield and quality parameters were recorded.

Higher pruned biomass was recorded in vines grafted on Dogridge (1.47 kg) as compared to own rooted vines (0.97 kg). Among the training modifications, four cordons exhibited higher pruned biomass (1.28 kg) followed by two cordon (1.23 kg) and single cordon (1.17 kg) respectively. The interaction effect for pruned biomass was non-significant.

The differences for shoot length were non-significant. Cane diameter was significantly different among the plant type. Grafted vines had higher cane diameter (9.03 mm) than own rooted vines (8.24 mm). The differences for cane diameter among the different training modifications were non-significant. Number of canes per vine differed significantly. Grafted vines produced more number of canes (40.3) than own rooted vines (38.5). Among the training modifications, four cordons produced more canes (56.3) followed by two (37.4) and single cordon (23.9) respectively.

Significantly higher number of bunches per vine were recorded in grafted vines (35.6) as compared to own rooted vines (17.3). The vines trained to four cordon had more bunches (30.8) followed by two and single cordons. The interaction effect was also significant. Higher number of bunches in grafted vines were recorded in four cordon trained vines (58.8). Significant differences were recorded for average bunch weight. The grafted vines recorded higher bunch weight of 191.07 g as compared to 155.13 g in own rooted vines. Single cordon recorded higher bunch weight of 177.70 g followed by four cordon (173.80 g) and two cordon (167.90 g) respectively.

Variation in yield level was recorded in own rooted and grafted vines. The vines grafted on rootstock produced higher yield of 6.65 kg as compared to 3.05 kg/vine in own rooted vines. The vines trained to four cordons yielded 7.85 kg/vine which was more than two cordons (3.45 kg) and single cordon (3.25 kg).

Effect of number of stems on growth and yield parameters

The vines were trained to one and two stems with single, two and four cordons. All the recommended cultural practices were followed to maintain vine. The data on different growth and yield parameters was collected.

Higher pruned biomass was recorded in the vines trained to two stems than in single stem. The differences for shoot length among the stems and training modifications were non-significant. Total numbers of canes/vine were higher in four cordon trained vines (68.6) as compared to other training modifications. Two stems trained vines recorded higher number of canes (46.6) compared to single stem (40.3). Cane diameter was less in four cordon trained vines than other training modifications. Two stems trained vines exhibited higher cane diameter (10.47 mm) than single stem (9.04 mm).

Higher number of bunches (67.1) were recorded in four cordons followed by two (46.4) and single cordon (34.8). The same trend was recorded for yield/vine. Among the training modifications, four cordons trained vines had higher yield (11.38 kg/vine) compared to two (10.46 kg/vine) and single cordon.

Standardization of canopy architecture on bower trained vines

Performance of own rooted vs. grafted vines

The vines were grafted on Dogridge rootstock and were trained to bower system of training. The vines were also trained to single, two and four cordons by varying the distance between two cordons. All the observations on growth and yield parameters were recorded during the season.

Grafted vines exhibited higher October pruned biomass of 0.91 kg as against 0.63 kg in own rooted vines. Among the treatments, four cordons with 1' 6" distance between cordons recorded higher pruning weight (0.83 kg) than other treatments. Shoot length was higher in single cordon with 2' 6" distance placed cordons (85.23 cm) as compared to two cordons with same distance (66.22 cm). Cane diameter differed significantly among own root vs. grafted but the differences among different modifications were non-significant. Number of canes/vine were higher in grafted vines (62.38) than in own rooted vines (57.81). Four cordon trained vines with 1' 6" distance had recorded higher number of canes (76.88) than other treatments.

Number of bunches increased with the increase in number of cordons and reduction in distance between two cordons. Higher number of bunches/vine were recorded in grafted vines (62.67) as compared to own rooted (43.10). Four cordon trained vines with 1' 6" placed cordons yielded an average of 66.45 bunches as against 42.10 in two cordon with 4' distance. Average bunch weight was higher in two and single cordon as compared to four cordons. The difference for berry diameter and TSS was non-significant. The yield/vine was significantly different among the different training modifications and plant type. Higher yield of 9.71 kg/vine was recorded in grafted vine as compared to 5.55 kg in own rooted vines. Four cordons trained vines with 1' 6" distance recorded a yield of 8.91 kg/vine as compaed to 6.47 kg in two cordon with 4' distance.

Performance of single stem and double stem in vines trained to bower system

Pruned biomass was higher in double stem (0.92 kg) than single stem (0.89 kg). Four cordons had higher biomass (0.97 kg) than in two (0.90 kg) and single cordon (0.85 kg). The differences for shoot length among the stem types were non-significant. Cane diameter was higher in single stem than in double stem. The differences for average bunch weight among the stem type was non-significant, however, among training modifications, single cordon exhibited higher average bunch weight of 330.36 g followed by two (293.30 g) and four cordon (266.47 g). The difference for number of bunches per vine and number of canes/ vine was non-significant among stem type. The yield per vine was significant. Double stem recorded higher yield of 13.57 kg compared to 12.14 kg in single stem. Four cordons recorded 14.38 kg as compared to 11.61 kg /vine in single and 12.57 kg in two cordons.

Standardizing potassium dose for Cabernet Sauvignon vines grafted on 110R rootstock

Experiment was initiated in 2009-10 cropping season with eight potassium levels namely 0 (control), 50, 100, 200, 300, 400, 500 and 600 kg K_2O/ha on Cabernet Sauvignon vines grafted on 110R rootstock. Potassium was applied in twelve splits in a year.

In the second year of experimentation, the lowest K content was observed in the tissues at veraison stage, after harvest, 45 days after foundation pruning and flowering stage in the control. Potassium application increased K content significantly at all the sampling stages over control (Fig. 2 to 4). Average yield and bunch number per vine increased significantly as a result of potassium application @ 100 kg K_2O/ha compared to control. However, beyond 100 kg K_2O/ha there was no significant increase in yield (Table 7). Potassium deficiency symptoms were noticed during early vegetative shoot growth stage where potassium was not applied (Fig. 5).

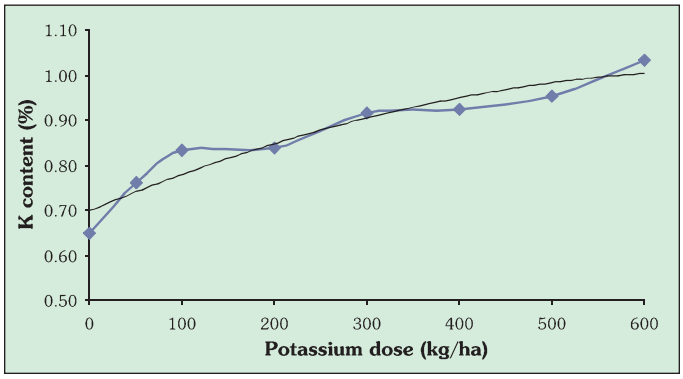


Fig. 2. Potassium content in petiole at 45 days after foundation pruning

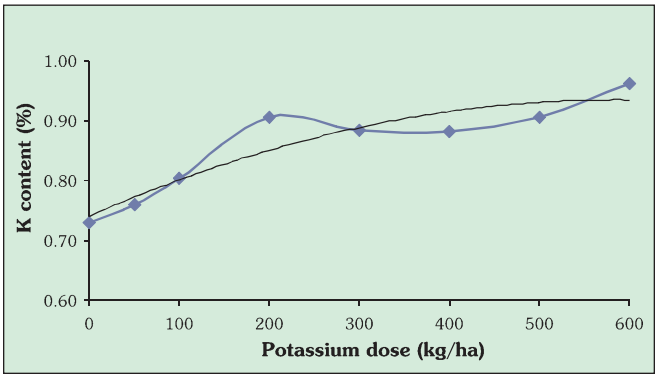


Fig. 3. Potassium content in petiole at flowering stage

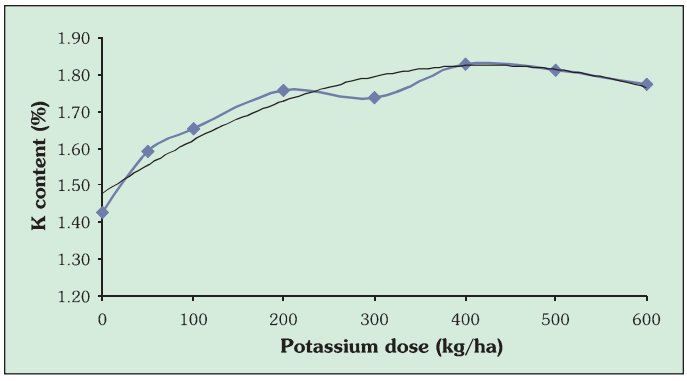


Fig. 4. Potassium content in petiole at veraison stage

Fig. 5. Potassium deficiency symptoms in control vines

Table 7. Effect of potassium levels on yield and yield parameters of Cabernet Sauvignon vines raised on 110R rootstock

Treatment (K_2O kg/ha)	Bunch number	Bunch weight (g)	Yield (t/ha)	TSS (°B)	Acidity (%)
T1 (control)	39.0	39.7	5.06	22.47	0.56
T2 (50kg K_2O)	46.0	40.0	6.12	23.20	0.55
T3 (100kg K_2O)	54.0	40.4	7.28	23.07	0.54
T4 (200kg K_2O)	52.0	43.5	7.48	23.07	0.54
T5 (300kg K_2O)	50.0	43.6	7.27	23.13	0.54
T6 (400kg K_2O)	55.0	40.2	7.35	22.97	0.55
T7 (500kg K_2O)	55.0	40.7	7.44	22.93	0.54
T8 (600kg K_2O)	51.0	43.1	7.38	23.30	0.54
SEm±	5.2	3.2	0.51	0.32	0.01
C.D. (p = 0.05)	11.16	NS	1.09	0.70	NS

Effect of rootstock on sodium and chloride accumulation in Fantasy Seedless under saline irrigation

This study was conducted in a Fantasy Seedless vineyard belonging to a grower's vineyard at Rahu village in 2010. The study area had uniform soil type, irrigated with saline irrigation water and raised under uniform management conditions. This was the first cropping season. Adjacent rows of Fantasy Seedless raised on 110R and Dogridge were selected for comparison. The petiole samples were drawn at harvest and the yield and yield related parameters were recorded and statistically analysed using Students' 't' test.

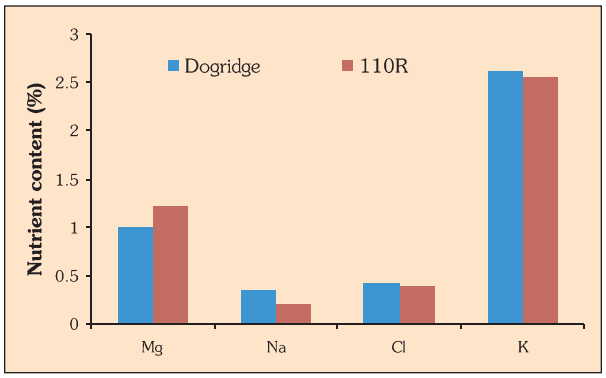


Fig. 6. Petiole nutrient content of vines of Fantasy Seedless raised on different rootstocks

Vines grafted on 110R rootstock had significantly higher bunch number (33) as compared to Dogridge rootstock (22). Average shoot length was significantly less in vines raised on 110R rootstock. Sodium (Na) content was significantly higher in petioles of vines grafted on Dogridge as compared to 110R rootstock (Fig. 6). Average sodium content in berries was also significantly less in case of 110R rootstock (17.5 ppm) compared to Dogridge (33.5 ppm). The results revealed that 110R was better than Dogridge in reducing Na accumulation in vines and also improved fruitfulness.

Nutrient composition of grape rachis exhibiting swelling

This disorder (symptoms shown in fig. 7) was reported from almost all the grape growing regions in Maharashtra. Initially the disorder was reported from table grape growing vineyards but now it is being reported in raisin grape growing vineyards also. All bunches on a vine were not affected by the abnormality. Further, sometimes healthy and affected bunches were present on the same shoot. The abnormal swelling can be visibly noticed two to three weeks after fruit set depending on the climatic conditions. In case of some vineyards bunches exhibited water berry and bunch stem necrosis symptoms also.

Fig. 7. Symptoms of swelling of rachis

Nutrient composition in the grape rachises from 17 grower's vineyards from Nasik, Pune and Sangli region belonging to Thompson Seedless and its mutants was determined. Healthy and symptomatic bunches belonged to the same vineyard. Initially petiole and cane nutrient status in a vineyard exhibiting rachis swelling and cracking symptoms was determined. As no particular trend was observed amongst the symptomatic and healthy vines in relation to nutrient content (Table 8), rachis samples were analysed. No conclusion could be drawn based on nutrient composition of the rachis from the vineyards under study during 2009-2010 cropping season (Table 9). The vineyards under study have received the nutrients in the form of foliar sprays also. These results suggested that nutrients were not directly implicated in the swelling of rachis.

Comparison of extractable K and Na with total K and Na content in vine tissues

The present method of estimation of K and Na in oven dried tissue requires use of expensive acids, instruments for digestion and consumption of electricity and are time consuming. In this experiment distilled water was used as extractant for estimation of K and Na in the dried grape leaf and petioles samples and compared with standard acid digestion method. A total of 126 petiole and 38 leaf blade samples were analysed. A significant and positive correlation was observed between the two methods for both K and Na in petiole as well as blade samples (Fig 8 to 11). The variation in the amounts of nutrients estimated by two methods was never more than 9.47 per cent in case of K and 8.77 per cent in case of Na. These variations though within acceptable limits were attributed to the estimation error although a great care was taken to minimise the errors.

Table 8. Nutrient content of petiole and cane in healthy and symptomatic vines

		N (%)	P (%)	K (%)	Ca (%)	Mg (%)	B (ppm)	Na (%)
Petiole of canes having healthy bunch	Without knot	0.74 – 0.82	0.18 – 0.20	2.65 – 3.00	1.82 – 2.16	0.45 – 0.53	42.00 – 46.00	0.50 – 0.54
Petiole of canes having affected bunch	With knot	0.70 – 0.76	0.12 – 0.18	2.40 – 2.88	1.59 – 1.65	0.37 – 0.40	36.00 – 42.00	0.50 – 0.60
	With knot bursted	0.91	0.14	3.85	1.80	0.42	40.00	0.55
Canes having healthy bunch	Without knot	0.50 – 0.56	0.12 – 0.14	1.72 – 1.80	0.42 – 0.45	0.10 – 0.12	18.00 – 20.00	0.22 – 0.25
Canes having affected bunch	With knot	0.46 – 0.63	0.10 – 0.19	1.90	0.40 – 0.42	0.10	16.00 – 22.00	0.20 – 0.23
	With knot bursted	0.58	0.16	1.76	0.38	0.1	18	0.24

Table 9. Nutrient content of rachis in healthy and symptomatic bunches

	Ca (%)		Mg (%)		B (ppm)		Na (%)	
	A	H	A	H	A	H	A	H
Max	0.83	0.96	0.09	0.08	44	40	0.53	0.57
Min	0.35	0.34	0.04	0.04	14	17	0.23	0.25
Mean (n = 17)	0.58	0.57	0.06	0.06	28	27	0.40	0.42

A: Affected H: Healthy

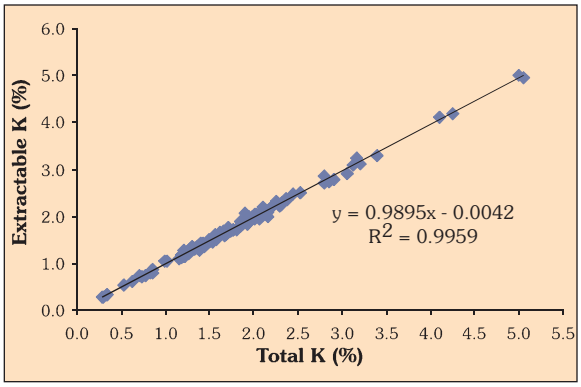


Fig. 8. Relationship between total and extractable potassium in petiole

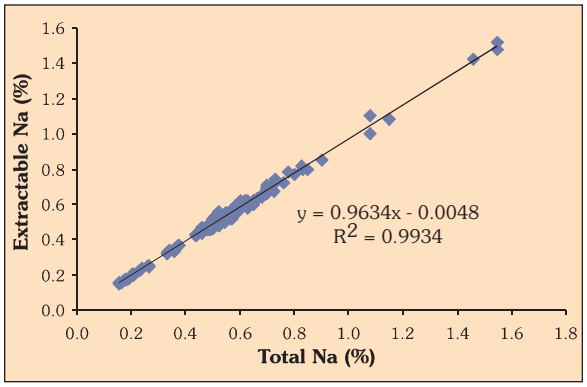


Fig. 9. Relationship between total and extractable sodium in petiole

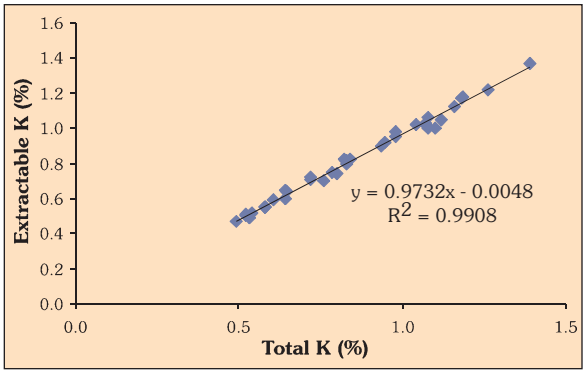


Fig. 10. Relationship between total and extractable potassium in leaf blade

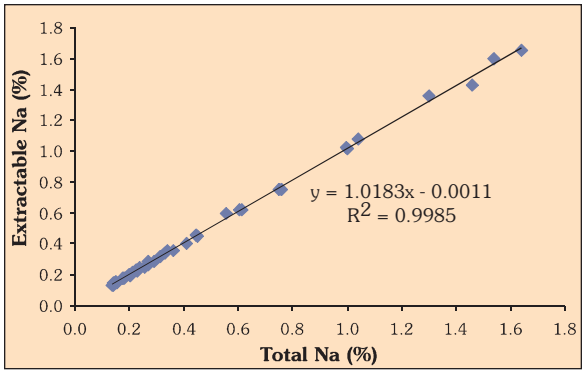


Fig. 11. Relationship between total and extractable sodium in leaf blade

Standardization of irrigation schedule for Cabernet Sauvignon vines raised on 110R rootstock

The experiment was initiated in 2010 with six treatments (irrigation schedule based on crop growth stage and recorded open pan evaporation) given in table 10 on vines raised under uniform management conditions. During the first 75 days the vines were not given external irrigation due to frequent rains.

Table 10. Irrigation schedule treatments of Cabernet Sauvignon vines raised on 110R rootstock

Growth Stage	T I	T II	T III	T IV	T V	T VI
Foundation Pruning/ Back Pruning						
Shoot growth (1-40 days)	45*	45	60	30	30	30
Fruit bud differentiation (41-60 days)	15	15	15	15	15	15
Cane maturity and Fruit bud development (61-120 days)	15	15	15	15	15	15
121days - fruit pruning	30	15	15	15	15	15
Fruit Pruning/ Forward Pruning						
Shoot growth (1-40 days)	45	45	60	30	30	30
Bloom to Shatter (40-55 day)	15	30	15	30	30	30
Berry growth and development (56-105 days)	45	30	30	30	15	15
Ripening to Harvest (106-145 days)	45	15	15	15	30	15
Rest period (20 days after harvest)	15	-	15	-	15	-

*= % replenishment based on open pan evaporimeter

The yield under different irrigation schedules ranged from 6.97 to 8.49 t/ha (Table 11). However, there were no significant differences amongst different treatments. Petiole samples at 45 days after foundation pruning and full bloom stage were analyzed for the nutritional status. There was no significant difference in N, P and K content at both the stages.

Table 11. Effect of irrigation treatments on yield and yield parameters

Treatment	Bunch weight (g)	Bunch number	TSS (°B)	Acidity (%)	Yield (t/ha)
T I	40.30	52	22.85	0.57	7.11
T II	40.00	55	22.65	0.54	7.38
T III	42.70	58	23.08	0.55	8.28
T IV	40.70	62	23.05	0.55	8.49
T V	38.40	54	22.68	0.54	6.98
T VI	39.90	52	22.93	0.56	6.97
SEm+	2.07	4.7	0.33	0.02	0.75
CD (p=0.05)	NS	NS	NS	NS	NS

Studies on pink berry in white grapes and its management

Effect of paper cover bags on incidence of pink berry formation

The purpose of this experiment was to manage the pink berry formation. Different types of paper bags were used to cover bunches at 75 days after pruning. The data indicated the significant differences with respect to number of pink berries in bunch, berry length, TSS, skin thickness and berry crispness. It was observed that covering the bunches with paper cover (enclosed), newspaper (open and closed) resulted in no pink berry formation. Hence, from this study it can be concluded that to manage pink berry formation, the bunches should be covered with white or newspapers at 75 days after pruning.

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

Standardization of bioregulators protocol for Red Globe

To standardize the optimal dose of bioregulators for Red Globe, combinations of different concentrations of GA_3 (20 and 30 ppm) and CPPU (0.25, 0.50 and 1 ppm) were used at 3-4 mm and again at 6-7 mm berry size stage. The data on bioregulators showed the significant differences in bunch weight, berry size, acidity and shelf life. Among the treatments, application of CPPU @ 1 ppm and GA_3 @ 20-30 ppm showed the best results with respect to above parameters. The experiment will be continued for two more years.

Persistence and dissipation study on bioregulators in grape

Field trials were conducted on various bioregulators at the farm of the NRC Grapes as well as in a nearby farmer's vineyard (Bafna farms, Pune). The commercial formulation of each chemical was sprayed at different doses and frequencies as per the critical usage pattern practised by growers. The samples were analysed for residues at regular time intervals. The application rates and dissipation rate kinetics results for various tested chemicals are given in table12.

Table 12. Residue analysis of bioregulators

Name of chemical	Application rate (ppm)	Half-life (days)	Pre-harvest interval (days)
Forchlorfenuron (CPPU)	2 4	6 7	39 58
6-Benzyl Adenine	10 20 30	3.25 3.30 3.30	13 16 17
GA_3	40 80 120	2.75 3.0 4.0	Residues were below the EU-MRL of 5.0 mg/kg on the day of application itself and hence no pre-harvest interval applicable for GA_3.
Homobrassinolide	0.6 1.2	Residues were below the limit of quantification of 0.01 mg/kg on the day of application itself and hence no half-life or pre-harvest interval applicable for homobrassinolide.	
Ethephon	600	3.5	17

New chemicals/ botanicals for improving bud break and grape quality

Bio-efficacy of Silixol in grapes

Silixol is a unique formulation of stabilized, highly concentrated silicic acid, the bio available form of silicon which is taken up by plants roots and transported to all plant parts. The trial was sponsored by M/s Prithvi Pvt. Ltd., Mumbai. This was the second year of experiment.

The maximum berry diameter was recorded in application of 2.0 L/ha Silixol and significant reduction of berry diameter was recorded in higher as well as lower doses of Silixol. Silixol application improved the berry length significantly. The maximum berry length was recorded with 3.0 litres Silixol in 3 split application. The Silixol application increased berry skin thickness up to 2.0 L/ha Silixol which was significantly superior over all the other treatments. Application of Silixol resulted in significant increase in the yield and the least PLW during 8 days in shelf.

Bio-efficacy of Milagro in grapes

Milagro L is an extract from sugarcane flowers. It acts as a biostimulant and found effective on all crops.

Milagro L application significantly affected all the berry parameters. The application of Milagro L @ 30 mL/100 L of spray solution recorded significantly higher bunch weight, the 50 berry weight, and diameter. Berry firmness and length were recorded higher with application of Milagro L @ 20 mL/100 L. Likewise, the berry skin thickness, TSS and acidity were recorded more in Milagro L treatments as compared to untreated control. The physiological loss in weight showed the significant differences from 4^{th} day onwards and application of 30 mL Milagro L/100 L water recorded the least loss of weight during the cold storage up to 7 days.

Plant Health Management

Efficacy of endophytic and non-endophytic bacteria for controlling grape diseases

The 25 bacterial isolates selected on the basis of in vitro evaluation, from the total 293 isolates from grape shoot, leaf, root and rhizosphere, were evaluated for control of downy mildew in pot trials. The pooled analysis of the three trials indicated that 6 isolates viz. 171, 204 and 219 gave significant reduction in PDI (Fig. 12 and 13), followed by isolates 205, 209, 198 and 201. The same 25 bacterial isolates were also evaluated for control of anthracnose in pot trials. The pooled analysis of the three trials indicated that 16 isolates gave significant reduction in PDI. Similarly these 25 bacterial isolates were also evaluated for control of powdery mildew on infected detached leaves. Isolates 38, 39 and 126 gave significant reduction in PDI.

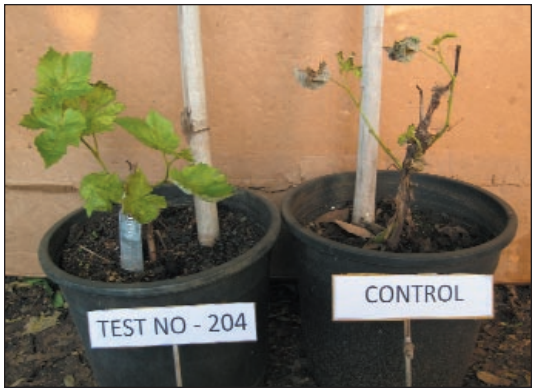


Fig. 12. Control of downy mildew by isolate 204

Efficacy of *Trichoderma* isolates for controlling grape diseases

Thirty four *Trichoderma* isolates were evaluated for control of powdery mildew on infected detached leaves. Fifteen isolates gave significant reduction in PDI. One isolate each of *T. harzianum* and *T. pseudokoningii* were most effective. All 34 *Trichoderma* isolates were also screened *in vitro* against *C. gloeosporioides*, and the most virulent ones were identified for *in vivo* trials. 14 isolates were evaluated for the control of downy mildew and anthracnose diseases on infected detached leaves. Two isolates each were found effective in reducing PDI.

Efficacy of *Trichoderma* isolates for degradation of the fungicide flusilazole

Thirty four *Trichoderma* isolates were evaluated *in vitro* for biodegradation of the fungicide flusilazole used for the control of powdery mildew in grapes. Some isolates could effectively degrade flusilazole from 0.5 ppm to less than 0.05 ppm (EU MRL limit) within 15 days. Four of these isolates provided cent per cent degradation. These isolates were selected for further studies on rate of degradation and other characteristics to select the most efficient ones for field trials.

Studies on bio-efficacy of fungicides and safer environmental profiles products for management of grape diseases

Management of downy mildew with non-systemic fungicides under different levels of growth retardation after foundation pruning

The experiment was conducted after foundation pruning in Thompson Seedless on bower system. The experiment was designed for the management of downy mildew, using different growth retardants and non-systemic fungicides. Different levels of growth retardation was created by using growth retardants such as paclobutrazole, propiconazole, chloromquate chloride, and monopotassium phosphate. During monsoon new shoots developed ahead of 12 nodes were physically removed and measured at about monthly interval. Observations on per cent disease index (PDI) were recorded when

highest level of incidence was noticed during September 2010 and per cent retention of leaves per cane was recorded just before forward pruning.

Length of shoots removed from plants treated with different growth retardants were substantially reduced, as compared to treatment with monopotassium phosphate and carbendazim. The data was non-significant for June and July shoot removals but significant for August shoot removals, indicating that the growth retardation effect was shown very late (Table 13). The paclobutrazol in particular has shown 2 to 3 times reduction in length of shoots removed during August. However, data on total length of shoots removed was non-significant. The retardation of growth was also indicated by reduction in nodal length. The paclobutrazole drenching treatment showed least nodal length, while propiconalzole sprays showed maximum nodal length.

Sprays of Bordeaux mixture 0.5 per cent and mancozeb 2.0 g/L in combination with different growth retardants, showed PDI of downy mildew on leaves in the range of 0.00 to 5.56 indicating good control of downy mildew (Table 14). Good control of downy mildew also resulted in retention of leaves in the range of 71 to 100 per cent. Mancozeb in paclobutrazole drenched plants showed significantly more disease and less retention of leaves as compared to Bordeaux mixture in paclobutrazole drenched plants.

Table13. Effect of growth retardants on length of shoot removed, grown beyond twelve nodes

Treatments for growth retardation	Dose	Length of shoots removed per vine* (cm)				10 Node length (cm)
		28.6.10	30.7.10	30.8.10	Total	
Paclobutrazole 23SC (Advika 23SC) as soil drenching	1.5 mL/L/plant	90.82	61.64	26.86	179.32	31.67
Propiconazole 25EC (Tilt 25EC) as spray	15 mL/100L	152.96	102.04	40.08	295.08	44.38
Chloromquat chloride (Lihocil) as spray	1 mL/L	124.92	88.44	41.07	254.43	38.13
Monopotassium phosphate (0:52:34) + carbendazim 50WP (Bavistin 50WP) as spray Followed by SOP spray after 5 days	5 + 1 g/L 4.0 g/L	158.48	94.28	60.52	313.28	39.13
CD (p = 0.05)		NS	NS	8.84	NS	2.18
CV (%)		–	–	16.40	–	4.76

*Each observation is an average of 50 canes spread over 10 plants in 5 replications

During June to October 2010 monsoon rains were good and achieving growth retardation and control of the downy mildew using only non-systemic fungicide is noteworthy. Growth retardation indirectly helped in reducing disease by escape mechanism, reduced labour cost required for physical removal of shoots and wastage of plant resources in the form of unwanted growth.

Different tissues from treatment plots were analysed for the residue of Paclobutazole, and Propiconazole, before forward pruning and no residues were detected.

Multilocational trials on bio-efficacy of new fungicides for the control of downy mildew

Experiments were set up at four locations at Sayad Pimpri (Nasik), Javale Kadlag (Sangamner), Nanaj (Solapur), and Killari (Latur) after forward pruning.

Based on the results at four locations the effective doses of fungicide were estimated (Table 15).

Results on terminal residues of different fungicides tested for bio-efficacy in control of downy mildew were below MRL even after 9 sprays at effective or above effective doses.

Table 14. Effect of growth retardation and fungicide sprays on Per cent Disease Index (PDI) of downy mildew on leaves

Treatments	Doses	PDI of downy mildew on leaves (%)	Leaves present on canes at forward pruning (%)
Paclobutrazole 23SC (Advika 23SC) as soil drenching + mancozeb spray	1.5 mL/L/plant + 2.0 g/L	5.56	82.75
Spray of propiconazole 25EC (Tilt 25EC) + mancozeb	0.15 mL/L + 2.0 g/L	2.63	71.00
Spray of chloromquat chloride (Lihocil) + mancozeb	1 mL/L	3.63	93.50
Spray of Monopotassium phosphate (0:52:34) + carbendazim 50WP (Bavistin 50WP) Followed by spray of SOP + mancozeb	5+ 1 g/L 4.0 g/L + 2.0 g/L	1.13	93.25
Paclobutrazole 23SC (Advika 23SC) as soil drenching + bordeaux mixture spray	1.5 mL/L/plant + 0.5%	0.00	100.00
Spray of propiconazole 25EC (Tilt 25EC) + bordeaux mixture	0.15 mL/L + 0.5%	1.50	92.25
Spray of chloromquat chloride (Lihocil) + bordeaux mixture	1.0 mL/L + 0.5%	0.00	95.50
Spray of monopotassium phosphate (0:52:34) + carbendazim 50WP (Bavistin 50WP) Followed by spray of SOP + bordeaux mixture	5 + 1 g/L 4.0 g/L + 0.5%	0.00	96.00
CD at 5%		2.69	14.38
CV (%)		17.82	13.17

*Each observation is an average of 50 canes spread over 10 plants in 5 replications

Table 15. Effective doses of fungicide for the control of downy mildew

Sr. No.	Name of fungicide and formulation	Effective dose
1.	Dimethomorph 12% + pyraclostrobin 6.7% (Cabrioteam 18.7 WG, BASF)	1.25 – 1.5 g/L
2.	Azoxystrobin 23SC (Indofil chemical Company Ltd.)	0.5 – 0.75 mL/L
3.	Azoxystrobin 23SC (Coromandal India Ltd.)	0.6 – 0.8 mL/L
4.	Azoxystrobin 23SC (Makhteshim Agan India Ltd.)	0.5 – 0.75 mL/L
5.	(Benalaxy 8% + mancozeb 65%) 73WP	Not effective
6.	Mancozeb 75WG (Indofil Chemical Company Ltd.)	Not effective

Bio-efficacy trial on powdery mildew

Effective doses observed for several fungicides are summarised in table 16.

Table 16. Effective doses of different fungicide for the control of powdery mildew

Sr. No	Name and formulation of the fungicide	Effective dose
1.	Boscalid 25.2% + pyraclostrobin 12.8% (Pristine 38WG, BASF)	0.5 – 0.6 g/L
2.	Metrofenon 50% (Vivando 50SC, BASF)	0.1 – 0.2 mL/L
3.	Penconazole (Syngenta India Ltd.)	0.5 mL/L
4.	Stabilised salicic acid 1.5% (Siloxil, Privi Pharma) + sulphur 80WDG	1.0 mL + 2.0 g/L
5.	*Bacillus subtilis* (Teagro, Novazyme)	Experiment was discontinued due to severe infection of downy mildew

Development and testing of disease forecasting models and development of pest alert systems

Preparation of grape advisory based on weather forecast

Weekly forecast of weather was collected from different websites and grape advisory based on weather forecast was prepared. Both weather forecast and grape advisory was placed on NRCG website and was available at http://nrcgrapes.nic.in/weather_forecast_based_grape_adv.htm The webpage was accessed for more than 52700 times.

Development of logic for generating location specific disease management advisory for vineyards using location specific weather forecast

Location specific weather forecast was successfully used for the management of downy mildew at 12 locations.

Validation of location specific weather forecast

Automated Weather Stations (AWS) were installed at five locations during July 2010 at Bhuyane (Satana), Palkhed and Khedgaon (Nasik), Walwa (Sangli) and Solapur. Location specific weather forecast was generated using longitude and latitude for all five locations from August 2010. M/s Express Weather provided AWS recorded weather data and forecasted weather data (For 7 days) for all 5 locations to us through computer interface on internet. Preciseness of forecasted weather data was tested for first 3 days forecast by comparing with AWS recorded data and there was no difference at all between AWS.

Use of location specific weather forecast for the management of downy mildew

Twelve private vineyards 0.4 ha each was selected for taking up weather forecast based disease management during fruiting season (October 2010 to April 2011). Six vineyards each were located in Sangli and Nasik districts. For all the vineyards location specific weather forecast was generated based on longitude and latitude observations. Field observations as well as weather forecast guidelines were used to decide on the strategic fungicide spray.

At all locations vineyard plot managed by us was compared with vineyard plot of same size, same date of pruning and adjacent to our vineyard but managed by owner grower. All vineyards managed by us showed good control of downy mildew and PDI of > 1.0 was recorded on leaves and bunches during first 50 days of forward pruning. Similar control of downy mildew was also recorded in grower managed vineyard. However, in vineyards managed by us there were 9 to 15 sprays for the control of downy mildew, while in grower managed vineyard there were 17-24 sprays for the control of downy mildew. Grapes from all the 12 locations were analysed for pesticide residue after 145 days of forward pruning. None of the grape samples showed residues of any pesticide above MRL. The yield from demonstration farms were better than the growers' farms as over spray resulted in chemical injury in many farms.

Survey of vineyards of wine grapes and table grapes for presence of GVLRaV strains

The survey was conducted during January – February 2011 in Nasik and Junner area. Only GLRaV 3 was detected in table grapes (Sharad Seedless and its clones, such as Krishna Seedless, Nana Seedless) and wine varieties (Cabernet Souvignone, Siraz), using both ELISA and RT-PCR based methods (Fig. 13). The symptoms were developed during January and later, especially after a cold wave.

Monitoring of development of symptoms and detectability of GLRaV-3 by ELISA and RT-PCR during different weather conditions and growth stages

Plants of Pinot Noir and Thompson Seedless which had been shown positive by both ELISA and RT-PCR based methods, were tested at monthly interval for GLRaV3 by both the methods. Development of symptoms on leaves was also recorded.

The results indicated that the symptoms such as red pigmentation and leaf curling were developed only in mature leaves after June, in case of vineyards pruned in April. During monsoon most of the time cloudy conditions prevailed and day temperature was below 30°C most of the time. Such mild conditions favour symptom production in Pinot Noir variety. However, Thompson Seedless remained symptomless carrier.

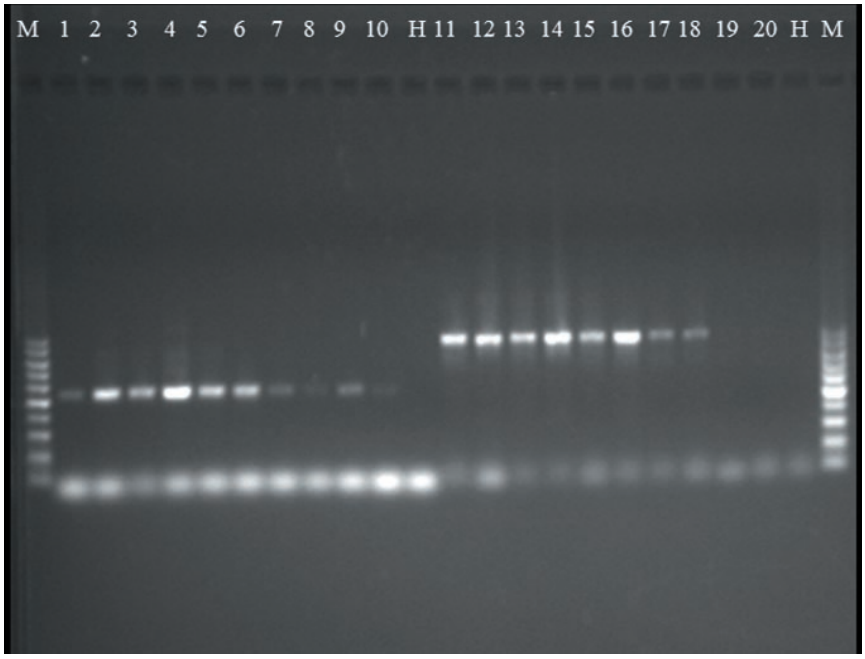


Fig. 13. RT-PCR for the detection of GLRaV3 in table and wine varieties in different vineyards. Lanes 1 – 10 = amplification with primer combination 7 and 8 and lanes 11-20 = amplification with primers CPf1 and CPr942, M = Ladder, H = Healty samples

Diagnosis and management of leaf-spot diseases of horticultural and field crops (ICAR-Out Reach Programme)

Diversity analysis

The identification of the 387 isolates previously done based on morphological characters had indicated that none of the isolates belonged to *E. ampelina* and belonged to *Colletotrichum* spp. Molecular methods were employed to confirm this. For the molecular analysis, at least two isolates selected to represent each morphological group, geographical region, cultivar and plant part were taken. Total genomic DNA was extracted from 5 days old fungal mycelium and PCR was performed. The species specific primers used were CgINT + ITS4 for *C. gloeosporioides*; CcINT + ITS4 for *C. capsici*; and 18s RNA F and R for *E. ampelina*. The amplified products were resolved by a 1.5% agarose gel electrophoresis.

All the 368 isolates identified as *C. gloeosporioides* based on morphological characters gave single specific fragment of approximately 450 base pairs with CgINT+ ITS4 confirming its identity. This primer pair did not amplify DNA from isolates belonging to *C. capsici.* Further, all the 14 isolates identified as *C. capsici* based on morphological characters gave single specific fragment of approximately 460 base pairs with CcINT+ITS4 confirming its identity. This primer pair did not amplify DNA from isolates belonging to *C. gloeosporioides*. All the 382 isolates identified as *C. capsici* or *C. gloeosporioides* gave single fragment with the forward and reverse primers from 18s

RNA of *E. ampelina*, which was more than the expected size of 500 bp, indicating that none of the isolates belong to *E. ampelina*.

In vitro fungicide sensitivity

The sensitivity of 30 isolates of *C. gloeosporioides* and 6 isolates of *C. capsici* representing different geographical regions, morphological groups and cultivars, to the commonly used fungicide carbendazim (Bavistin 50% WP) belonging to the benzimidazole group and a triazole group fungicide viz. flusilazole (Nustar 40 % EC) and a strobilurin group fungicide viz. azoxystrobin (Amistar 23 SC) was studied in vitro. Both the pathogens were more sensitive to flusilazole and azoxystrobin than carbendazim. Among the *Colletotrichum* spp. *C. capsici* was less sensitive than *C. gloeosporioides* to carbendazim and flusilazole but more sensitive to azoxystrobin. The EC_{50} values are given in table 17.

Table 17. Sensitivity of *Colletotrichum* spp. to different fungicides

Sr. No.	Fungicide	*Colletotrichum* spp.	EC 50 (ppm)	Range (ppm)
1.	Carbendazim	*C. gloeosporioides*	4.9 ± 5.8	26.7 - 1.4
2.	Carbendazim	*C. capsici*	20.8 ± 7.6	27.4 - 10.0
3.	Flusilazole	*C. gloeosporioides*	1.0 ± 0.3	1.4 - 0.2
4.	Flusilazole	*C. capsici*	2.0 ± 0.8	2.7 - 0.4
5.	Azoxystrobin	*C. gloeosporioides*	1.0 ± 0.42	2.3 - 0.5
6.	Azoxystrobin	*C. capsici*	0.5 ± 0.11	0.6 - 0.3

In vivo fungicide efficacy

Seven new generation fungicides viz. azoxystrobin (Amistar 23% SC) 0.5 mL/L, flusilazole (Nustar 40% EC) 0.125 mL/L, kresoxim methyl (Ergon 44.3% SC) 0.6 mL/L, trifloxystrobin + tebuconazole (Nativo) 0.15 g/L, pyraclostrobin + metiram (Cabrio Top) 1.75 g/L, tebuconazole (Folicur 25.9%) 0.5 mL/L and difenconazole (Score 25% EC) 0.5 mL/L were tested for their efficacy in management of anthracnose disease at the research farm of NRCG, Pune. Carbendazim 1.0 g/L was used as positive control. Spraying was started when weather conditions became favorable for appearance of the disease. Four sprays were given at weekly intervals.

All the tested fungicides significantly reduced PDI of anthracnose during the period of observation, except trifloxystrobin + tebuconazole (Nativo) on the first observation. Pyraclostrobin + metiram (Cabrio top), flusilazole and carbendazim recorded least PDI of anthracnose on all observations.

Pathogenicity and virulence

Isolates identified based on morphology and molecular studies as *C. gloeosporioides* and *C. capsici* were tested for pathogenicity to Tas-A-Ganesh and Thompson Seedless following Koch's Postulates. Both species were found pathogenic.

The virulence of the *C. gloeosporioides* and *C. capsici* isolates was tested on different varieties. *C. gloeosporioides* was more virulent on Tas-A-Ganesh (8.0 lesions per leaf of 8.0 ± 2.4 mm size) than 2A clone (4.75 lesions per leaf of 5.4 ± 2.4 mm size) and Thompson Seedless (6.5 lesions per leaf of 3.1 ± 0.6 mm size). *C. capsici* was more virulent on 2A clone (6.5 lesions per leaf of 10.2 ± 2.3 mm size) than Tas-A-Ganesh (3.8 lesions per leaf of 2.9 ± 0.8 mm size) and Thompson Seedless (1.3 lesions per leaf of 1.8 ± 0.2 mm size).

Screening of germplasm to identify resistant sources for anthracnose disease

The germplasm accessions, including table, wine and raisins maintained at Centre's National Active-Germplasm Site were screened for their reaction to anthracnose disease under natural epiphytotic conditions, for finding resistance sources against anthracnose disease. Accessions which rated as resistant in field were tested *in vitro* under controlled conditions after artificial inoculation. Twenty four accessions were rated as resistant based on *in vivo* and *in vitro* evaluation. 52 accessions were found resistant *in vivo* and confirmed *in vitro*.

Seasonal incidence of insect pests and their natural enemies in grape vineyards and their population dynamics

Out of four species of thrips found during survey in Nasik, Sangli, Pune and Solapur areas two new species were identified as *Scirtothrips dorsalis* and *Retithrips syriacus*. *Retithrips syriacus* was found to be infesting older leaves during off-season and after harvesting of crop during fruiting season. Specimens of a species were sent to NBAII, Bangalore for identification. Thrips infestation during first 60 days of October Pruning was found to be lower (1.5 thrips/vine) as compared to previous year's due to rains till November, 2010. However, late thrips were found to cause damage up to 90 days of pruning resulting into berry scaring in Sangli, Pune and Solapur areas and up to 110 days in Nasik region. Further the studies have also shown that the thrips population build-up was coincided with decrease in the humidity and absence of rains to complete life cycle.

The mite causing the damage to grapes was identified as red spider mite, *Tetranychus urticae* in all the grape growing areas. More than 60% of the leaves were found infested with mites at some pockets in Sangli, Pandharpur and Solapur areas. Mite infestation was found to be lower in Nasik as compared to Sangli and Pandharpur. Two predators of mites were also found in Pune and Sangli areas which are yet to be identified. Mite population was found to increase from 90 mites per leaf in second fortnight of December and peaked to 136.30 mites per leaf in January and remained near this level up to March, 2011 at NRCG farm, Pune. Population build up was attributed to increase in temperature and absence of rains. Three predators were found with possible association with mites and being evaluated for their potential. Preliminary lab study on water spray showed promising results for reducing mites and preliminary field study on alternate host plants showed many plants in vineyards harbouring mites.

The mealy bug species causing the damage to grapes was identified as *Maconellicoccus hirsutus* in all the grape growing areas. Two different species of lady bird beetle were also found in a vineyard infested with mealy bugs in Savlaj area of Sangli, one of the species was identified as *Cheilomenes sexmaculata* (Fabricius). In addition, *Chrysoperla carnia* larvae were found predating mealy bugs at Savlaj and Takli areas of Sangli. Mealy bug infestation was found in up to 80% of plants in some area

Sangli and Nasik during first fortnight of January which started declining afterwards. Mealy bug infestation was found to be lower during 2010-11 fruiting season as compared to previous season. Mealy bug population build up was attributed to increase in temperature and absence of rains.

Evaluation of promising physical and cultural methods of insect pest management

Use of blue and yellow sticky traps for the management of thrips and jassids, removal of loose bark and dead woods, destruction of infected pruned material, removal of weeds and alternated host plants for the management of mealy bugs is under further investigation and thereafter these measures will be included in their respective IPM schedule.

Evaluation of botanicals, petroleum products and new chemicals for their bio-efficacy, effect on natural enemies and their phytotoxicity in grapes

Seventeen different insecticides including botanicals and new molecules were evaluated for their bio-efficacy against thrips. Sixteen were found to be effective against thrips. The effective chemicals and their effective doses are Fipronil 5 SC (0.8 mL/L), Thiamethoxam (0.25 mL/L), Imidacloprid 17.8 SL (0.3 mL/L), Spinosad 45SC (0.25 mL/L), Dimethoate 30 EC (1 mL/L), Azadirachtin 300 and 10,000 ppm (2 mL/L), Emamectin Benzoate 05 SG (0.22 g/L), Lamda-cyhalothrin 05 EC (0.5 mL/L), Abamectin 1.9 EC (0.5 mL/L), Imidacloprid 30.5% SC (0.25 mL/L), Mealyquit (5 mL/L), Mealykill (5 mL/L), Cyzapyr 10% OD (0.7 mL/L), Bollcure crude (10 g/L), Bollcure (5 mL/L), Spiro. 120 + Imida. 120 (75+75 a.i./ha). Flubendiamide 480 SC (0.25 mL/L), was found ineffective.

In addition, 40 different pesticides including all fungicides and insecticides registered in grapes, petroleum oil, detergent, new molecules viz. Lastraw, Stylet Oil, Chlorine di oxide, HGW 10% OD, Spirotetramat + Imidacloprid and botanical viz. Spida were evaluated for their bio-efficacy against mites and 27 of them were found effective. They are Abamectin (0.30 mL/L), Dicofol (2 mL/L), Suplher (2 g/L), Difenthiuron (0.80 mL/L), Spirotetramate (0.5 mL/L), Floramite (0.50 mL/L), Propargite (0.75 mL/L), Azadirachtin10000 ppm (5 mL/L), Azadirachtin 10000 ppm (2 mL/L), Azadirachtin 1500 ppm (3 mL/L), Azadirachtin 300 ppm (5 mL/L), *Pseudomonas flurescens* (5 mL/L), Spida (1 mL/L), Cyzapyr 10% OD (0.7 mL/L), Thimethoxam 25 WG (0.25 g/L), Emamectin Benzoate 5SG (0.22 g/L), Methomyl 40SP (1g/L), Fenpyroximate 5SC (1.5 mL/L), Stylet Oil (5 mL/L), Lastraw (5 mL/L), Mac Hmo All Season (1 mL/L), Kresoxin methyl (700 mL/ha), Dinocap (0.35 mL/L), Potassium bicarbonate (10 g/L), Mancozeb (2 g/L), COC (2-3 g/L), Copper Hydrochloride (1.5 g/L), Ketosan (1.2), Chlorine di oxide (5 mL/L).

Similarly, 17 chemicals involving petroleum oil, detergent, new molecules viz. Lastraw, Stylet Oil, HGW 10% OD, Spirotetramat + Imidacloprid and botanical viz. Spida and neem oil were evaluated for the management of mealy bugs and all were found effective. The effective chemicals and their effective doses are Spida (1 mL/L), Spiro+ imida (75+75 a.i./ha), Bollucure (7.5 mL/L), Bollcure crude (10 g/L), Neem Oil (+1g detergent) (2 mL/L), Abamectin (0.5 mL/L), Detergent (5 g/L, 10 g/L, 15 g/L), Lambda-Cyhalothrin (0.5 mL/L), Methomyl (1 g/L), Buprofezin (1.25 mL/L), Chloropyriphos (2 mL/L), Dichlorovos (2 mL/L), Sulphur 80 WDG (2.5 g/L), Neemzal (5 mL/L), Lastraw (5 mL/L), Petroleum oil (5 mL/L), Fish oil soap (5 mL/L).

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

Persistence and dissipation study on Azoxystrobin

Azoxystrobin, a strobilurin fungicide was applied at the rates of 0.5 (single) and 1.0 (double) mL/L of the commercial formulation containing the active ingredient at 23.5 % SC. Residues were estimated by LC-MS/MS after extraction by the method developed and validated at NRL. The degradation of the residues followed 1^{st} + 1^{st} order kinetics with half-lives of 8.75 and 9 days with PHIs of 7 and 13 days respectively, at single and double doses of application with respect to the EU-MRL of 2 mg/kg. The residues degraded were found to be below the limit of quantification of 0.01 mg/g after 30 days from the date of application.

Persistence and dissipation of glyphosate in grapes

Glyphosate is a broad spectrum, post-emergent herbicide frequently used by grape growers for general purpose weed management. A research trial was conducted with Glyphosate 66% SL, at the application rates of 800 g a.i./ha (1212 mL/ha on formulation basis) and 1600 g a.i./ha (2424 mL/ha on formulation basis) on separate plots before berry initiation stage. The grape leaf and berry samples were collected at different stages. The concentrations of glyphosate residues were below the limit of quantification of 0.01 mg/kg in all the leaf and berry samples analyzed on the day of application until harvest.

Dissipation of Chlormequat chloride (CCC) residues in grapevines

Field experiments were conducted in selected growers' vineyards in Nasik and Sangli districts with different timing of CCC applications as given below:

- CCC application both after foundation and forward pruning in 2010.
- CCC application only after foundation pruning and no application after forward pruning in 2010.
- CCC was not applied either after foundation or forward pruning 2010 with last application in forward pruning 2009.

The quantity of CCC used in last two years varied from 2100 mL to 9600 mL. Samples of different growth stages and plant parts (Stage 1: Cane/Stem, Stage 2: Leaf, Stage 3: Flowering, Stage 4: Veraison, Stage 5: Harvest) were collected and analyzed for CCC residues. The residues of CCC were traced at levels above the EU-MRL of 0.05 mg/kg in all growth stage samples before veraison (Stage 4) in plots where no application of CCC was done after 2010 October pruning. At veraison (Stage 4), the residues of CCC dissipated to below the EU-MRL of 0.05 mg/kg. In trial plots where no CCC was applied both after foundation and forward pruning of 2010, CCC was traced in all the growth stage samples monitored, although the residues were below the MRL and in the range of 0.005-0.02 mg/kg. In the trial plot where, CCC was applied after both the foundation and forward 2010 prunings, residue was detected at above the EU-MRL in all growth stages and in the range of 0.2 mg/kg at veraison stage of grape berries, which is significantly above the EU-MRL.

Monitoring of agrochemical residues in grape and grape produce

Development of multiresidue method for microextraction in processed products (juices)

Water based samples such as flavoured drinks, juices and drinking water may contain contaminants at ultra-trace level belonging to different chemical classes. A novel, simple, low-cost and fast method was developed and validated for trace residue extraction of pesticides, dioxin-like PCBs (polychlorinated biphenyls) and PAHs (polyaromatic hydrocarbons) from water and water based samples followed by analysis through gas chromatography (GC) coupled with time-of-flight mass spectrometry (ToFMS). The extraction solvent type, volume; sample volume and other extraction conditions were optimized. In brief the analysis was achieved by extracting 10 mL sample with 250 µL chloroform by vortexing (1 min, standing time of 2 min) followed by centrifugation (6000 rpm, 5 min). The bottom organic layer (200 µL) was pipetted out, evaporated to dryness and reconstituted in 20 µL of ethyl acetate + cyclohexane (1:9) mixture resulting in an enrichment factor of 400. The recoveries of all compounds were within 76-120 % (± 10%) with LODs ranging from 1-250 ng/L depending on the analyte response. The method was further validated in water based drinks (e.g. apple, lemon, pineapple, orange, grape and pomegranate juice). For the juices with suspended pulp, the extraction was carried out with 400 µL chloroform. The extract was analyzed by GC-ToFMS at both 1-Dimension and GCxGC modes to separate interfering compounds that could not be reduced otherwise. The resulting peak table was filtered to identify a range of compounds belonging to specific classes viz. polycyclic aromatic hydrocarbons, chlorinated, brominated, and nitro compounds. User developed scripts were employed on the basis of identification of the molecular ion and isotope clusters or other spectral characteristics.

Monitoring of agrochemical residues in Indian wine

Samples collected from different Indian wineries were screened for a list of 171 agrochemicals and ochratoxin-A, and found mostly to be free from any contaminant residues. In few samples, carbendazim was detected; however, the residue values were much below the EU-MRL applicable for wine grapes (0.5 mg/kg). Around 60 samples of red and white wines were evaluated as a part of the initiative to establish the quality standards of Indian wines.

Development and validation of a simple analytical method for the determination of 2,4,6-trichloroanisole (TCA) in wine by GC–MS

A novel method for the residue analysis of wine spoilage compound 2,4,6-trichloroanisole (TCA) is reported. Wine (60 mL) was extracted with 2 mL toluene in presence of 24 g $MgSO_4$ and 6 g NaCl. Clean-up of the toluene phase by dispersive solid phase extraction with mixture of 100 mg $CaCl_2$, 25 mg primary secondary amine and 50 mg $MgSO_4$ was effective in minimising co-extractives and matrix effects. Time-of-flight and tandem mass spectrometric parameters were optimised to achieve linearity over 0.25–500 ng/mL and method detection limit 0.0083 ng/mL, which is well below the odour threshold of 0.04 ng/mL. Recoveries at 0.04, 0.2 and 0.8 ng/mL were within 80–110% (±8%). The method was reproducible when tested for Argentinean wines with satisfactory intra-laboratory Horwitz ratios for precision being <0.20 in white and red wines at both the laboratories of India and Argentina.

Persistence studies of agrochemical residues in soil and water

Sorption (adsorption-desorption) and degradation of paclobutrazol

Sorption and degradation behaviour of the growth regulator paclobutrazol were investigated in three soils viz. clay (C), sandy-loam (SL) and sandy (S). Sorption experiments were carried out in laboratory batch experiments by shaking soil with a solution of the formulation (1:2 w/w) prepared in 0.01 M $CaCl_2$. Field experiments in a randomized block design were conducted for dissipation studies.

The experimental data for sorption fitted the Lindstrom model which was employed for the simultaneous evaluation of adsorption and desorption kinetics. The rate constants for adsorption and desorption at two different temperatures (4°C and 25°C) were obtained from the Lindstrom model. Adsorption was fast in all the three soils and reached equilibrium within 30 minutes. The data for rate constants, activation energies, enthalpy of activation, entropy of activation and free energy indicated physical adsorption of paclobutrazole on soil.

The data for degradation of the residues of paclobutrazol in soil fitted to 1^{st} + 1^{st} order rate kinetics with $r^2 > 0.99$. Adsorption at the temperature of 25°C followed the order S>SL>C, while desorption followed the order SL>S>C. At 4°C temperature, adsorption followed the order SL>S>C while desorption followed the order C>S>SL. The degradation was studied in soil at single (8 mg/kg) and double field application rates (16 mg/kg). In all soils paclobutrazole degraded within 30 days from the date of application to below 0.05 mg/kg. Degradation was faster in single dose than in double dose applications.

Persistence of glyphosate in soils of different physico-chemical properties

Persistence of glyphosate residues in three soils (viz. sandy, sandy loam and clay) was studied at the application rates of 1 (T1) and 2 µg/g (T2) soil. Half-life of glyphosate was 21.5 and 23.5 days in sandy soil for T1 and T2 respectively. In sandy loam soil, half-lives of 25.5 and 27.5 days were observed for T1 and T2; whereas in clay soil, the half-life values were 33.5 and 37.5 days for T1 and T2, respectively. It could be concluded that glyphosate degradation was faster in sandy soil followed by sandy loam and clay soil.

Persistence and degradation of glyphosate residues in water at different pH

Experiments for degradation of glyphosate in water at different pH was conducted at 2 (single dose) and 4 µg/g (double dose) under in-vitro condition. At pH 4, half-life was 100 days for both single and double doses, while at pH 7, half-life came down to 76 days at both doses. At pH 9.2, degradation was faster at single dose (half-life of 60 days) as compared to double dose (half-life of 67 days). In general, the degradation rate of glyphosate was faster at alkaline to neutral pH in comparison to acidic pH.

Post-Harvest Technology

Studies on wines

Effect of pruning time and bunch load on berry parameters of Cabernet Sauvignon

The vines of Cabernet Sauvignon were maintained with 20 and 30 bunches at NRCG vineyard. The

bunches were harvested after 152 and 159 days after pruning. The results of berry analysis showed that the higher berry weight (average of 10 bunches), TSS, TTA, anthocyanins and total phenols were obtained in 20 bunches/vine as compared to 30 bunches/vine.

Vines of Cabernet Sauvignon were pruned on 15th Sep and 21st Sep at NRCG vineyard. The bunches from these were handpicked at 159 and 152 days after pruning for I and II pruning, respectively. The data showed that more TSS was recorded in vines pruned later however, anthocyanins and phenols content was more in berries from vines pruned earlier.

Effect of pruning time and cane numbers on berry parameters of Shiraz

In another experiment, the vines of Shiraz were pruned on 24th and 28th September 2011. To maintain the crop load, 14, 16 and 18 canes per vine were maintained. Grapes were harvested at 159 and 155 days after I and II pruning, respectively. The data of must analysis showed low pH, TTA and juice recovery in late pruned vines. But phenols and anthocyanins content was more in must from early pruned vines. Higher TSS was recorded for berries which developed on 14 canes /vine treatment.

Effect of fining materials on quality parameters of Cabernet Sauvignon wine

To study effect of fining material, 200 mL wine of Cabernet Sauvignon were used for each treatment. Three levels of Bentonite (0.3, 0.6 and 1 g/L) and two levels of gelatin (0.05 and 0.1 g/L) were used. The samples were homogenized at 200 rpm for 20 minutes. These samples were kept for 8 days for fining. The supernatant was collected and various parameters were analyzed by using standard operating procedures. The application of both fining materials affected studied parameters. The declined trend was noted in colour intensity, anthocyanins, protein and phenols. More tint was observed in treated wines in comparison to untreated wines.

Comparison of various Bentonite doses for fining of Cabernet Sauvignon wine

To compare effect of Bentonite application on fining, 200 mL wine of Cabernet Sauvignon were used for each treatment. Different levels of Bentonite (0.2, 0.4, 0.6, 0.8, 1.0 and 1.2 g/L) were used for fining. The samples were homogenized at 200 rpm for 20 minutes. These samples were kept for 8 days for fining. The supernatant was collected and various parameters were analyzed by using standard operating procedures. The amount colour intensity, anthocyanins and protein content decreased with increasing Bentonite concentration whereas Tint increased at higher Bentonite levels.

Studies on raisin

An experiment was conducted to minimize the colour intensity of raisins using different combinations of different concentrations of ethyl oleate (15, 20 and 25 mL/L) and potassium carbonate (30, 40 and 50 g/L). Minimum colour intensity was observed when grapes were treated with 15 mL/L ethyl oleate and 30 g/L potassium carbonate. In an another experiment, grapes were pretreated with different concentrations of ascorbic acid (100, 200 and 300 ppm) and followed by dipping in 15 mL/L ethyl oleate and 25 g/L potassium carbonate. Pre-treatment with 200 ppm ascorbic acid resulted in minimum colour intensity.

Collaborative, Externally Funded, Contract Research and Consultancy Projects

Indo France Project on Evaluation of wine grapes under Indian condition.

This Indo-French collaborative project on wine grapes is between NRC for Grapes and M/s Viniflhor, Ministry of Agriculture and Fisheries, Govt. of France, Paris. Under this project, the plants of nineteen wine varieties grafted on 110R rootstock were planted in the field. The wine varieties were Colombard (W), Gewurztraminer P, Riesling (W), Sauvignon (W), Muscat (W), Chenin (W), Gros Manseng (W), Vermentino (W), Viognier (W), Cabernet Sauvignon (R), Cabernet Franc (R), Merlot (R), Petit Verdot (R), Tempranillo (R), Niellucio R (Sangioves), Grenache N, Caladoc (R), Cinsaut (R) and Syrah (R).The framework development of these varieties is completed. Besides these different varieties, Cabernet Sauvignon grafted on different rootstocks viz. 101.14 MGT, 140 RU, 1103P, SO4, Gravesac, Fercal, 110R and Dogridge were also planted in the field and framework development was completed. The planting material for this project was received from nursery of ENTAV, France.

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 eighth year of the Residue Monitoring Plan, initiated by the APEDA, Ministry of Commerce, Government of India in 2003-04 with National Research Centre for Grapes, Pune through the National Referral Laboratory (NRL) setup under this institute. The NRL was initially set up for monitoring of pesticide residues in table grapes.

Presently three state Governments viz. Maharashtra, Andhra Pradesh and Karnataka are covered under this plan since exportable grapes are produced in these states. The farms from where table grapes are to be exported are registered with the Agricultural Departments of the respective grape growing states. The total registered farms for export of table grapes as per our records in these states were 15840. Out of these farms, 15757 farms were from Maharashtra alone.

Under the Pesticide Residue Monitoring Plan, eight APEDA-nominated laboratories viz. Vimta Labs Ltd. (Hyderabad), Reliable Laboratories (Thane), Geo-Chem Laboratories (Mumbai), SGS laboratories (Chennai), National Horticulture Research and Development Foundation (NHRDF, Nashik), Delhi Test House (Delhi), National Collateral Management Services Limited actively participated in drawing of samples and residue monitoring. In addition, 9 more nominated laboratories viz. Pesticide Residue Testing Laboratory (Pune), True Analytica (Chennai), Sargam Laboratory (Chennai), Shiva Analyticals (Bangalore), Doctors Analytical Laboratories Pvt. Ltd. (Pune), Interfield Laboratories (Kochi), Shriram Institute for Industrial Research (Bangalore), Arbro Pharmaceuticals Ltd. (Delhi) and Sipra laboratories (Hydrabad) participated in the proficiency test (PT) rounds organized by the NRL, but they did not analyze any export grape samples under the Grapenet in this year due to inadequate infrastructure.

Proficiency test

The first Proficiency Testing (PT) round among the nominated laboratories was organized on 23rd November 2010 for the chemicals viz. glyphosate and chlormequat chloride. A unique code number was assigned to each 17 participating laboratories to maintain confidentiality. PT samples with unknown residue description were distributed among these laboratories at random and they were asked to submit the results to the NRL. The laboratory results were compared to the true values and

the 'Z'-scores was determined for individual chemicals pertaining to 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. In the above PT round the performance of most of the laboratories was not satisfactory. A hands on training program was therefore conducted for the laboratories on 4th December 2010 on analysis of glyphosate and Chormequat Chloride followed by distribution of second round of PT samples for analysis of these chemicals. The results of the laboratories were found to be satisfactory in terms of the 'Z' scores obtained.

The third PT round was conducted on 8th January 2011. In this progamme, 17 APEDA nominated laboratories participated. The laboratories were asked to analyse the samples for all the 171 chemicals in the monitoring list. The results of NCMSL (Hyderabad), NHRDF (Nashik), Reliable (Mumbai), Geochem (Mumbai), SGS (Chennai), Vimta (Bengaluru) and DTH (Delhi) were satisfactory in terms of identification of spiked pesticides and the corresponding 'Z'-scores and they were immediately allowed by the NRL for access into the Grapenet software system. Considering the readiness and assessment of the laboratory another PT was conducted and Microchem Laboratory (Mumbai) was authorized for grape testing with effect from 18th February 2011. The performance of remaining laboratories was not found satisfactory.

Ring test with EU laboratories

Ring-Test programme was conducted in February 2011 by the National Referral Laboratory to evaluate the performance of the laboratories for the grape season of 2011. The ring test was conducted targeting 171 chemicals (including pesticides, growth hormones, heavy metals, etc.). In the ring test, eleven (11) Indian laboratories engaged in grape residue testing and 3 European laboratories (AgriQ Group BV, Wageningen, The Netherlands; Eurofins - Dr. Specht Express, Hamburg, Germany; and QTS Analytical Ltd., Kent, UK) participated. Each laboratory was assigned a unique code number to maintain confidentiality. The grape juice used as test material for the analysis was spiked with chemicals (11 Nos. from the list of 171) in bulk and distributed to all. They were requested to identify and quantify the residues present in the test material and forward their results with the chromatograms / mass spectra / calculation details, etc. to the National Referral Laboratory within one week.

The Z scores of the participating laboratories for all the test chemicals were within the satisfactory range of -2 to +2 for all the spiked agro chemicals. The performance of Indian laboratories was 'equivalent to better' in comparison to the performance of the three European laboratories.

Training Programmes organised

A training programme on efficient use of LC-MS for pesticides residue analysis was organized on 7-8th January 2011, at NRL where representatives from all APEDA nominated laboratories participated.

A hands on training programme was organized at Ricklit Institute of food safety, Wageningen, Netherland, during 17-21st January 2011. 23 chemists from different nominated laboratories and the NRL participated in this training.

Research activities

In last one year, the NRL could expand the scope of the multiresidue analysis method to cover testing of more than 200 pesticides in various fruits and vegetable matrices viz. grape, pomegranate, mango, spinach, tomato, okra, onion, etc. on GC-MS and LC-MS/MS. A method have been also developed and validated for the analysis of plant growth regulators from grapes including homobrassinolide. A micro-extraction method involving small quantity of extraction solvent was developed for the analysis of pesticides and other contaminants from various water and water based commodities viz, grapes, pomegranate, orange, apple, lemon, pineapple. A UPLC based method was developed for the analysis of allicin from the garlic samples.

Monitoring results

A total of 3173 table grape samples were tested in the 2010-11 season by eight nominated laboratories, which include first sample as well as resample. The district wise distribution of passed and failed samples pertaining to the States of Maharashtra, Karnataka and Andhra Pradesh are presented below:

Out of the 3173 total analyzed samples, 601 samples failed for EU-MRL compliance. Thus, a total 601 internal alerts were issued. On re-sampling after the recommended pre-harvest intervals, 109 alerts were subsequently revoked on the basis of the MRL compliance in analyses reports. Thus the number of effective alerts was 492 as compared to 314 in previous year.

Among the nominated laboratories, the highest numbers of samples were analyzed by M/s Geochem Laboratories, Mumbai followed by SGS India Pvt. Ltd., Chennai and M/s Reliable Laboratories, Mumbai.

In totality, there were 36 pesticides for which MRL exceedances were recorded in the 2011 season. Most frequently detected pesticide was Chlormequat chloride (CCC) with 226 detections. Next to the CCC, the major plant growth regulator, 6-benzyl adenine was detected in 42 samples. The major insecticides that got detected in this season include fipronil with 154 detections and the other pesticides viz. abamectin, lambda-Cyhalothrin, acetamiprid and chlorpyriphos which were detected in 106, 39, 33 and 22 samples, respectively. In case of the fungicides, highest detected chemical was captan with 31 detections followed by flusilazole with 27 detections.

Out of the 492 effective alerts, which accounts for 15.5% of the samples analyzed, most of the cases correspond to the pesticides, which are mostly used during the last two months before harvest. Hence, the management of these pests before harvest will certainly play a key role in minimizing the residues of pesticides in next grape season of 2010-11. In this season, maximum number of alerts was pertaining to CCC, which might occur as a result of applications of this chemical as a plant growth regulator. The frequent detection of this chemical could be because of excessive use by the growers and/or slow degradation of this chemical.

The detections of the non-recommended chemicals indicate increasing awareness among the grape growers to use the non-recommended chemicals for pest management.

ii. 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) – Final report

This BARC-BRNS funded project was in collaboration with BARC and was completed on 30th June 2010. The salient results of the project work conducted at the NRC Grapes are as follows:

- 10 rootstocks viz. Dog ridge (*V. champinii*), Salt Creek (*V. champinii*), St. George (*V. rupestris*), 1613C (*Solonis* x *Othello*), 110R (*V. berlandierii* x *V. rupestris*), 99R (*V. berlandierii* x *V. rupestris*), 1103P (*V. berlandierii* x *V. rupestris*), B2-56 (*V. berlandierii* x *V. rupestris*), *V. longii*, Teleki 5 A (*V. berlandierii* x *V. riparia*) were subjected to water stress and salinity stress separately.
- Based on the preliminary results, 110R and Salt Creek as the most tolerant and 1613C as the most susceptible rootstock were identified for detailed physiological, biochemical and molecular analysis. Dogridge rootstock though less tolerant than 110R and Salt Creek was also included, as it has been widely planted in the farmer's field. These four rootstocks were subjected to water and salinity stress separately and in combination.
- Total protein content varied significantly in response to salinity as well as combined stress among different rootstocks.
- Salinity and combined stress both had significant effect on total sugar and phenolics accumulation in these rootstocks.
- Proline accumulation pattern varied in different rootstocks in response to stress. In 110R there was no significant difference in proline accumulation under salinity stress, whereas proline content increased in response to water and combined water and salinity stress. On the other hand, increase in proline content was observed in Dogridge under salinity stress at later stages.
- Glycine betain accumulation did not follow any particular trend in any of the rootstock and in general maximum glycine betain content was obtained in control vines.
- Water potential in different rootstocks in response to different treatments was recorded on 21 and 28 days of experiment. There was differential change in leaf water potential of different rootstocks. At the end of experiment, in 110R the leaf water potential of stressed vines treated with 2EC saline water was more than the control vine while at 4EC level it was equal to control.
- Sodium content in the leaf blade increased with increasing salinity levels in the rootstocks 1613C, Dogridge and Salt Creek. However no specific trend was observed in rootstock 110R. All the rootstocks except 1613C maintained potassium content above 1% or above in the leaf blade. Increased potassium and sodium content were observed in leaf blades under combined stress as compared to control vines in all the rootstocks.
- RNA was extracted from young leaves of 110R and 1613C from all the treatments. Based on the sequence information available in online grape gene index database, primers were designed to study the expression of Na^+/H^+ antiporter gene, a gene known to be involved in salinity tolerance. The real time PCR was used for relative quantification of gene expression in different treatments. Three biological replicates and two technical replicates were used as recommended for real time PCR.

- The expression of Na^+/H^+ antiporter gene was found to be upregulated in 110R in response to salinity.
- RNA from 110R was used for DDRT-PCR. Different anchor primers in combination with arbitrary primers resulted in different banding pattern among four samples.
- 42 primer combinations resulted into total 502 bands. 41 (7.5%) bands were present only in the control. These bands were down regulated in response to stress. 36 (6.5%) bands were present only in the salt stress vines. These bands were up regulated in response to salt stress. 24 (4.3%) bands were present in moisture stress. Thus these bands were up regulated in response to moisture stress. 27 (4.9%) bands were present in combined stress. This may show common fragments involved in the moisture and salinity stress.
- Total 13 (2.5%) bands were present in moisture, salinity and combined stress. These bands were up regulated through common pathway in response to stress. 4 (0.7%) bands were present in control and moisture stress. 11 (2%) bands were present in control and salinity stress. These bands were down regulated during moisture stress. 6 (1.09%) bands were present in salinity and moisture stress thus were up regulated in response to salinity and moisture stress. 8 (0.3%) bands were present in moisture and combined stress suggesting their down regulation in response to salt stress.

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

Report presented under 3.1.

iv. Intellectual property management and transfer / commercialization of agricultural technology (NAIP-ICAR Scheme)

The Centre is a part of west zone of Intellectual Property Management and Transfer / Commercialization of Agricultural Technology. As part of the project, information on thirteen technologies and two copyrights obtained by the Institute was compiled. A world-wide patented technology map related to grapes was compiled. A performa was prepared for patent application for filing plant patent through PCT in USA and European countries. The Co-PI of the project participated in DST- Technology Expo meet in Pune and ZTM-BPD meeting cum workshop at Mumbai. The Institute Technology Management Committee was reconstituted.

Technology Assessed and Transferred

Besides several other technologies which are developed and assessed at the Institute were 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

- Drs. P. G. Adsule, S. D. Sawant, A. K. Upadhyay, S. D. Ramteke, J. Sharma, Mrs. S. Shalini and D. S. Yadav visited demonstration plots at 12 locations in Sangli and Nasik region. Visits were made at different stages of crop growth and based on the performance recoemmendations were made. During each visit large number of farmers attended the meeting.

- Dr. S. D. Ramteke visited Odiapati, Cumbum of Theni district, Tamil Nadu and Satana of Nasik district, Maharashtra during 22-28th July and 8-9th September 2010 respectively, to conduct the residue trials of bioregulators. Berry cracking was observed at both the places since it is an off-season cultivation of grapes particularly in Nasik. Growers were suggested to maintain optimum canopy. Application of CPPU @ 0.5 ppm - 1 ppm at 6-7 mm berry stage may reduce berry cracking. Application of $Ca_2(NO_3)_2$ at 75 days after pruning @0.5 - 1% was also suggested. In Theni around 100 farmers participated in in-house discussion. Around 50 farmers participated in discussion and agreed to implement the practices.

- Dr. R. G. Somkuwar visited rootstock planted field in Nasik region on 1st July 2010 for checking the purity of rootstock in the field of Sh. Suresh Kalamkar of Mohadi. During the visit it was observed that there was a mixture of V. longi and Salt Creek rootstock in the main field of Dogridge planted garden. The farmer was advised to remove the off type plants and replace with Dogridge.

- Dr. R. G. Somkuwar visited vineyard of M/s Champagne India Ltd on 18th July 2010 for observing fruitfulness in wine varieties grafted on different rootstock. The vines were not irrigated after harvest of last season crop due to some problem and hence, the fruitfulness in the shoots was not sure. Pruning by retaining old and new wood was decided for conducting the trial in the coming season.

- Dr. J. Sharma attended growers' meet and field visit to Satana, Yesagaon, and Namgaon on 18th August 2010 organized by M/s Bayer Crop Science. Around 30-40 farmers participated.

- Dr. R. G. Somkuwar and Dr. A. K. Upadhyay visited vineyards in Mizoram during 30th August to 3rd September 2010. The main problem noticed in the vineyards was the downy mildew disease infection. The grape growers were informed about the fungicides to be used for the control of different diseases. They were also advised to regularly refer website of NRC Grapes. Training system

being used in the area is not as per the canopy of the vines in the region. The grape growers were also guided on the training importance to harvest maximum sunlight and to achieve disease free high quality fruit.

- Dr. J. Satisha and Dr. A. K. Sharma visited wine grape vineyards of M/s Sula wineries to perform pruning operation on wine varieties under the Institute project on wine grapes on 24th September 2010. A lot of sprouting on defoliated canes due to high temperature before pruning itself was observed. It was suggested to perform pruning operation at the earliest to prevent exhaustion of food reserves, which is required for bud burst after pruning.
- Dr. S. D. Ramteke visited the vineyards in and around Nasik and had a discussion on 'Judicious use of bioregulators in grapes' with the grape growers. This visit was organised by M/s Syngenta at Nasik on 29-30th October 2010.
- Dr. P. G. Adsule visited vineyards of table grapes in Jaysingpur, Sangli area and interaced with farmers for management of various diseases and use of agro-chemicals on 28th November 2010.
- Dr. G. S. Karibasappa, Dr. J. Satisha and Dr. Roshni R. Samarth visited Agharkar Research Institute, Hol Farm, Baramati on 4th February 2011 to collect germplasm from their breeding block. Advised them to follow good viticultural practices to maintain good growth and development of all the accessions.
- Dr. P. G. Adsule had a meeting with grape growers preparing raisins and also table grapes for export in Sangli on 13th February 2011.
- Dr. S. D. Sawant visited grape growing areas of Cumbam Valley, Tamil Nadu during November 2010 and February 2011. During first visit GPS data of the valley was collected and survey was conducted for presence of anthracnose disease in the area. During second visit grape growers gathering was addressed for giving guidelines on disease management using weather forecast

Participation in Growers' Seminar

- Dr. A. K. Upadhyay participated in Charchasatra and delivered lecture on 'Water and nutritional issues in grapes during foundation pruning at Tasgaon on 7th April 2010.
- Dr. R. G. Somkuwar and Dr. S. D. Ramteke delivered lectures on 'Canopy management after back pruning' and 'Use of bioregulators after back pruning in grapes' respectively in the seminar organized by Maharashtra State Grape Growers' Association at Nasik on 11th April 2010. Seminar was attended by 200 - 3300 grape growers.
- Dr. R. G. Somkuwar delivered lecture on 'Canopy management after back pruning' in the seminars organized by Maharashtra State Grape Growers' Association at Solapur on 14th April, at Sangli on 22nd April, at Sangamner on 29th April, at Malegaon on 18th August, and at Nasik on 7th September 2010. Each seminar was attended by 200 - 3300 grape growers.
- Mrs. S. Salini participated in Charchasatra and delivered a lecture on 'Insect management in grapes after foundation pruning' in grape growers' seminar organized by Maharashtra State Grape Growers' Association at Sangli on 22nd April 2010.

- Dr. A. K. Upadhyay participated in Charchasatra and delivered lecture on 'Water and nutritional issues in grapes during foundation pruning' organized by M/s Deepak Fertilizers and Petrochemicals Corp. Ltd at Sangli on 23rd April under IRGS programme.
- Dr. A. K. Upadhyay and Mrs. S. Salini participated in Charchasatra and delivered lectures on 'Water and nutritional issues in grapes during Foundation pruning' and 'Insect management in grapes after foundation pruning' respectively in seminar organized by Maharashtra State Grape Growers' Association at Sangamner on 29th April 2010.
- Dr. S. D. Sawant, Dr. R. G. Somkuwar, Dr. A. K. Upadhyay, Dr. S. D. Ramteke, Dr. J. Sharma and Dr. D. S. Yadav participated and delivered lectures in the Regional Charchasatra organized by Maharashtra State Grape Growers' Association at Nasik on 11th May 2010.
- Dr. A. K. Upadhyay participated in pre monsoon seminar regarding water and nutritional issues in grapes during foundation pruning at Nasik on 12th May 2010.
- Dr. J. Sharma delivered lecture on 'Nutrient and water management in grapes during foundation pruning' in growers' seminar organized by Maharashtra State Grape Growers' Association at Latur on 13th May 2010. About 400 growers attended the programme.
- Dr. J. Sharma delivered lecture on 'Nutrient and water management in grapes during foundation pruning' in grower' seminar organized by Maharashtra State Grape Growers' Association at Solapur on 14th May 2010. About 700 growers attended the programme.
- Dr. J. Satisha delivered a lecture on 'Impact of cluster exposure to sunlight on fruit composition of Norton grapes' in Viticulture Field Day organized by ICCVE and Missouri Grape Growers Association, at Hermann, MO on 8th June 2010.
- Dr. S. D. Ramteke delivered lecture on 'Use of bioregulators in grapes' in growers' seminar at Theni, Tamil Nadu on 26th July 2010. Approximately 40 grape growers attended the seminar.
- Dr. S. D. Ramteke delivered lecture on 'Use of NAA in grapes to increase the shelf life' at Cumbum Valley on 11th August 2010. Approximately 100 grape growers attended the lecture.
- Dr. J. Sharma participated in growers' seminar organized by M/s Bayer Crop Science at Malegaon on 17th August 2010. Around 300 farmers attended the programme.
- Dr. J. Sharma delivered lecture on 'Nutrient and water management in grapes during fruit pruning' in grower' seminar organized by Maharashtra State Grape Growers' Association at Sangli on 26th August and at Tasgaon on 27th August 2010. About 600 growers attended the programme.
- Dr. S. D. Ramteke and Dr. D. S. Yadav delivered lectures on 'Use of Bioregulators in grapes' and 'Pest management in grapes' respectively in the seminar organized by Maharashtra State Grape Growers' Association at Nasik on 7th September 2010. Approximately 300 grape growers attended the seminar.
- Dr. S. D. Sawant and Dr. A. K. Upadhyay delivered lectures on 'Strategis for disease management in grapes' and 'Water and nutritional issues in grapes during fruit pruning' respectively in grape

growers' seminar organized by M/s Deepak Fertilizers & Petrochemicals Corp. Ltd. at Ugar, Karnataka on 20th September 2010.

- Dr. S. D. Sawant talked on 'Strageties for disease management in grapes' in the programme sponsored by Grape Exporting Corporate Body M/s Amaya Foods, Nasik on 25th September 2010.
- Dr. G. S. Karibasappa, Dr. S. D. Sawant, Dr. Indu S. Sawant, Dr. R. G. Somkuwar, Dr. K. Banerjee, Dr. S. D. Ramteke, Dr. J. Sharma, Dr. D. S. Yadav and Mrs. S. Salini participated in the Golden Jubilee Seminar of Maharashtra State Grape Growers' Association on 26th September 2010 at Pune and delivered lectures on concerned aspects of grape improvement, production and protection.
- Dr. S. D. Sawant, Dr. R. G. Somkuwar, Dr. S. D. Ramteke, Dr. J. Sharma and Dr. D. S. Yadav participated and delivered lectures in the Regional Charchasatra organized by Maharashtra State Grape Growers' Association at Solapur on 5th October and at Latur on 6th October 2010. Approximately 1000 grape growers attended the lecture.
- Dr. J. Sharma delivered lecture on 'Nutrient and water management in grapes during fruit pruning' in seminar organized by by Maharashtra State Grape Growers' Association at Nasik in October, 2010. About 2500 growers attended the programme.
- Dr. S. D. Sawant talked on 'Strageties for disease management in grapes' in the programme organized by Krishi Vigyan Kendra, Baramati on 3rd November 2010.
- Dr. A. K. Upadhyay participated in the Charchasatra organized by Maharashtra State Grape Growers' Association at Baramati on 3rd November 2010.
- Dr. D. S. Yadav delivered a lecture on 'Pest Management in Grapes' during grape growers meet organized by APMC at Tasgaon on 11th November 2010.
- Dr. D. S. Yadav delivered a lecture on 'Pest Management in Export Grapes' during programme organized by Maharashtra State Grape Growers' Association at Pandharpur on 16th November 2010.
- Dr. S. D. Ramteke delivered lecture on 'Grape varieties suitable for Cumbum valley region' in a seminar at Theni on 20th November 2010. Approximately 1500 grape growers attended the lecture.
- Dr. S. D. Ramteke and Dr. J. Sharma delivered lectures on 'Judicious use of bioregulators in grapes' and 'Nutrient and water management in grapes' in a seminar organized by M/s Privi Pharma Ltd., Mumbai at Tasgaon, Sangli on 20-21st December 2010. Approximately 200 grape growers attended the lecture.
- Dr. S. D. Ramteke delivered lecture on 'Judicious use of bioregulators in grapes' in the seminars organized by M/s Syngenta Pvt. Ltd., Pune at Sangli on 14-15th January and at Nasik on 19-20th January 2011. Approximately 700 grape growers attended the lecture.

- Dr. J. Sharma talked on 'Nutrient and water management in grapes during foundation pruning' in Growers' seminar organized by Maharashtra State Grape Growers' Association at Sangli for forward pruning season in 2010. About 600 growers attended the programme.

Participation in Exhibition

An exhibition stall was arranged in HORTI EXPO 2010 organized on the occasion of National Conference on "Horticultural Biodiversity for Livelihood, Economic Development and Health Care" organized by Lt. Amit Singh Memorial Foundation and University of Horticultural Sciences, at Bangalore during 29-31st May 2010.

Weather forecast based grape advice on the website of NRC for Grapes, Pune

Webpage on weekly weather forecast for different grape growing areas (Nasik, Sangli, Solapur, Pune, Bijapur and Hyderabad) and advice on plant protection based on estimated disease and pest risk considering weather forecast was updated at weekly interval regularly through the year. There was very good response from the grape growers to this page. As per counter fixed on the page, the count on visites to this webpage has crossed 52000 by February 2011.

TV Programme

Somkuwar R. G. Leaf fall and prepruning practice telecasted by DD Sahyadri on 10th September 2010 at 18:15 hrs.

Somkuwar R. G. Production of quality planting material telecasted by DD Sahyadri on 15th September 2010 at 06:07 hrs.

Somkuwar R. G. Grape cultivation status at Mizoram telecasted by Mizoram DD channel on 2nd September 2010.

Education and Training

Deputation Abroad

- Dr. J. Satisha, Sr. Scientist, completed two years of deputation as Postdoctoral Research Associate at Institute for Continental Climate Viticulture and Enology, University of Missouri, Columbia, USA from 9th August 2008 to 8th August 2010. During his deputation he was involved in several viticultural research projects on 'Influence of cluster exposure', 'Canopy management and canopy architecture', 'Vineyard mechanization' and 'Evaluation of grape rootstocks for commercial wine grape cultivars'. During his study, he also attended 60th Annual meeting of American Society of Enology and Viticulture at Napa, California and presented poster on 'Influence of rootstocks on growth, yield and fruit composition of Thompson Seedless grafted on different rootstocks'. He also participated in Mid-West Grape and Wine Conference held at Osage Beach, Lake of the Ozark, Missouri during 2009 and 2010 and presented oral presentation on 'Influence of cluster exposure to sunlight on fruit composition of Norton grapes'.

- Dr. A. K. Upadhyay, Dr. K. Banerjee, Dr. Dashrath Oulkar, Mr. Bharat Ugare and Mr. Sagar Utture participated in the training programme at Rikilt Institute of Food Safety at Wageningen in The Netherlands during 17-21st January 2011. This has given the participants a comprehensive understanding about their status of equipments, methods practised, their utility in residue monitoring and the areas to be addressed in future keeping in view the upcoming food safety requirement.

Training Acquired

- Mrs. S. Salini attended a training programme 'Agro-ecology and Integrated Pest Management in Horticultural crops' organized during 28-29th July 2010 at Shivajinagar Pune.

- Mrs. S. Salini attended Summer School on "Advances in Agricultural Acarology" organized at University of Agricultural Sciences, Bangalore during 8-28th October 2010.

- Dr. A. K. Goswami attended FOCARS training from 1st September 2010 to 29th December 2010 at NAARM Hyderabad.

- Dr. P. B. Taware attended Training Course on Research Station Management organized by International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh during 17-22nd January 2011.

- Dr. S. D. Sawant and Dr. R. G. Somkuwar participated in the workshop on 'Management of Stress Related disorders – Hypertension, Diabetes, Cardiac, musculo-skeletal and other psycho-somatic diseases' organized by NAARM, Hyderabad during 2-4th February 2011.

- Dr. Anuradha Upadhyay participated in the Bioinformatics training workshop 'Gene Expression Data Analysis and Structural Bioinformatics' organized at NBPGR, New Delhi during 1-12th March 2011.

- Dr. A. K. Goswami participated in the Training Programme on "Quantifying the Impact of Climate Change on Agriculture" organized by National Centre for Agricultural Economics and Policy Research, New Delhi during 21-25th March 2011.

Training Programmes Organized

- Two training programmes on 'Plant Protection in Two Pruning and Single Cropping System in Viticulture' were organized at the Centre during 5-6th August and 13-15th September 2010. Altogether 50 participants participated in these programmes. Dr. Indu S. Sawant coordinated the training programmes.
- A training programme entitled 'Transfer of Technology for Production of Export Quality Grapes' was organized at the Centre during 17-18th September 2010. Fifteen participants participated in the programme. Dr. S. D. Ramteke coordinated the training programme.
- A training programme entitled 'Grapevine Cultivation and its Value Added Products' was organized at the Centre during 21-24th March 2011.. Twenty-four participants from Tamil Nadu participated in the programme. Dr. R.G. Somkuwar coordinated the training programme.

Training Given / Summer training

- Scientists of the Centre were the resource persons for the training programme organized by Maharashtra State Grape Growers' Association at Pune on 16th July 2010. Forty five grape growers participated in the training programme.
- Dr. S. D. Sawant, Dr. R. G. Somkuwar and Dr. D. S. Yadav guided the grape growers and officers/staff in the training workshop organized to implement regulation of export of fresh grapes to the European Union through control of pesticide residues and global gap standardization. This workshop was organized by the Director, Agro Processing and Planning Division, Commissionerate of Agriculture, Govt. of Maharashtra, Pune on 14th November at Pandharpur; on 23rd November at Khed (Rajgurunagar), Pune; on 24th November 2010 at Vita, Sangli; and on 30th November 2010 at Ozar, Nasik.
- Dr. S. D. Sawant, Dr. A. K. Upadhyay, Dr. K. Banerjee, Dr. S. D. Ramteke and Dr. D. S. Yadav gave presentation on 'Package of Practices for Exportable Grapes' in the workshop on 'Adoption of Good Agriculture Practices and GAP Certification in Grape' organized by Maharashtra State Horticulture and Medicinal Plants Board, Shivajinagar, Pune on 1st January at Pune; on 5th January 2011 at Latur.
- Dr. S. D. Sawant was resource person for 21 days training programme on Crop Micrometeorology organized by Department of Agriculture Meteorology, College of Agriculture, Pune. He delivered lecture on 'Disease forecasting models in crops' on 10th February 2011.
- Dr. Indu S. Sawant provided training on 'Large scale multiplication of *Trichoderma* and other bio agents and their methods of application' on 2nd March 2011 to the participants of the project on

'Biotechnology led organic production of horticultural crops' to 28 SMS of 14 KVKs from NE India at ICAR Complex, Barapani, Shillong.

Post Graduate Project Work

Name of Scientist	Title of the project	Duration	No. of students	Institution
Dr. A. K. Sharma	1. Evaluation of fermentation efficiency of yeast strains and their effect on quality of wines. 2. A study on physico-chemical changes in grapes during raisin making.	Six months	One One	Jamia Hamdard, New Delhi Jamia Hamdard, New Delhi
Dr. Anuradha Upadhyay	1. Molecular characterisation of grape accessions. 2. Gene expression analysis of grape rootstocks in response to drought and salinity stress.	4-6 months 4 months	Two One	D. Y. Patil University, Pune L. P. University, Jallundhar University of Pune, Pune

Awards and Recognitions

- The presentation of research paper entitled 'AFLP marker to differentiate clone of grapevine (*Vitis Vinifera* L.) cv. Centennial Seedless by Manisha P. Shinde, Lalitkumar B. Aher, Anuradha Upadhyay and G. S. Karibasappa received first prize at National Seminar on 'Frontiers in Biotechnology and Bioinformatics' held on 12th February 2011 at D.Y. Patil Biotechnology and Bioinformatics Institute, Pune. The paper was presented by Ms. Manisha Shinde, SRF.

- Dr. G. S. Karibasappa was appointed as QRT member for NRC on Pomegranate, Solapur and attended a meeting on 28-29th September 2010. He was also honoured by Shri Sharad Pawar, Hon'ble Minister of Agriculture, Govt. of India on the occasion of Golden Jubilee Annual Seminar of Maharashtra State Grape Growers' Association on 26th September 2010 at Pune.

- Dr. Indu S. Sawant was nominated as a member on the Institute Management Committee of NRC for Citrus, Nagpur for a period of three years w.e.f. 9th August 2010.

- Dr. Indu S. Sawant acted as rapporteur in the 'National Symposium on Molecular Approaches for Management of Fungal Diseases of Crop Plants' 27-30th December 2010 organized by Indian Institute of Horticultural Research, Bangalore, for sessions on 'genetic diversity of fungal pathogens', and 'Nanotechnology in fungal disease diagnostics and management'.

- Dr. S. D. Sawant was identified as a resource person for M.Sc. (Virology) programme of National Institute of Virology. He delivered lectures on viral diseases in agricultural, horticultural and forestry plant and their management to 20 PG students and demonstrated the detection of GVLRaV3 by RT-PCR.

- Dr. R. G. Somkuwar is nominated from Institute side as Subject Matter Specialist/Expert for the State LOI Committee of NHB under the scheme 'Development of Commercial Horticulture through Production and Post Harvest Management. He also received 'Rashtriya Ekatmata Fellowship-2010' from Bharatiya Samaj Vikas Academy, Mumbai on 27th September 2010 at Pune.

- Dr. Anuradha Upadhyay is recognized as research guide by Shivaji University, Kolhapur for Ph.D. in Biotechnology.

- Dr. S. D. Ramteke was recognized as examiner for Plant Physiology course of College of Agriculture, Bhimraygudi, University of Agricultural Sciences, Raichur, Karnataka.

- Dr. P. B. Taware, T-5 has been awarded Ph.D. degree in botany by University of Pune on 9th January 2011. His thesis was entitled 'Patho-physiological studies on powdery mildew infected grapes and effect of disease on wine quality'.

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. Identification of drought and salt stress inducible genes in grape rootstocks and their role in physio-biochemical responses under abiotic stresses (BARC) (up to June 2010).

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

iv. Intellectual Property Management and transfer/commercialization of agricultural technology (NAIP).

International Collaboration

i. Indo-French collaboration project on wine grapes.

Publications

Research Articles

1. Banerjee Kaushik, Dasgupta S., Jadhav M.R., Naik D.G., Ligon A.P., Oulkar D.P., Savant R.H. and Adsule P.G. 2010. A fast, cheap and safe method for the residue analysis of meptyldinocap in different fruits by liquid chromatography tandem mass spectrometry. *J. AOAC Int*. **93(6):** 1957-1964.

2. Banerjee Kaushik, Savant R. H., Dasgupta S., Patil S. H., Oulkar D. P. and Adsule P. G. 2010. Multiresidue Analysis of Synthetic Pyrethroid Pesticides in Grapes by Gas Chromatography with Programmed Temperature Vaporizing–Large Volume Injection Coupled with Ion Trap Mass Spectrometry. *J. AOAC Int.* **93(2):** 368-379.

3. Banerjee Kaushik. 2010. Novel GC/MS, HPLC/MS, and HPLC-Diode Array Detector based methods for determination of pesticide residues in food, feed, water, and soil samples. Special Guest Editorial. *J. AOAC Int*. **93(2):** 1-2.

4. Dasgupta S., Banerjee Kaushik, Dhumal K. N. and Adsule P. G. 2011. Optimization of detection conditions and single laboratory validation of a multiresidue method for the determination of 135 pesticides and 25 organic pollutants in grape and wine by gas chromatography time-of-flight mass spectrometry. *J. AOAC Int*. **94(1):** 273-285.

5. Dasgupta S., Banerjee Kaushik, Patil S. H., Ghaste M. S., Dhumal K. N. and Adsule P. G. 2010. Optimization and comparison of one- and two dimensional gas chromatography time-of-flight mass spectrometry for separation and estimation of the residues of 160 pesticides and 25 persistent organic pollutants in grape and wine. *J. Chromatogr*. **A 1217:** 3881-3889.

6. Fontana A. R., Patil, S. H., Banerjee Kaushik, Altamirano J. (2010). Ultrasound-assisted emulsification microextraction for determination of 2,4,6-trichloroanisole in wine samples by gas chromatography tandem mass spectrometry. *J. Agric. Food Chem*. **58:** 4576-4581.

7. Patil S. H., Banerjee Kaushik, Utture S. C., Fontana A. R., Altamirano, J., Oulkar D. P., Wagh S. S., Dasgupta S., Patil S. B., Jadhav M. R., Ugare B. R., Adsule P. G. and Deshmukh M. B. 2011. Development and validation of a simple analytical method for the determination of 2,4,6-trichloroanisole in wine by GC-MS. *Food Chem*. **124:** 1734-1740.

8. Ramteke S. D. and Somkuwar R. G. 2010. Biochemical changes associated with hydrogen cyanamide induced bud break in grapes. Journal of Maharashtra Agricultural Universities. **35(3):** 470-474.

9. Satisha J., Oulkar Dashrath P., Banerjee Kaushik, Raveendran Poornima and Rokade Narendra P. 2010. Amino acid composition of major table and wine grape cultivars growing under semi-arid climate in India. *Horticulture Environment and Biotechnology*. **51(3):** 226-234.

10. Satisha J., Oulkar Dashrath P., Banerjee Kaushik, Raveendran Poornima and Rokade Narendra P. 2010. Amino acid profile of Thompson Seedless grapes grafted on different rootstocks at various stages of berry development. *Intl. J. of Fruit Science*. **10(3):** 323-340.

11. Satisha Jogaiah, Somkuwar R. G., Sharma Jagdev, Upadhyay A. K. and Adsule P. G., 2010. Influence of rootstocks on growth, yield and fruit composition of T. Seedless grapes grown in Pune region of India. *South African J. Enol. Vitic*., **31:** 1-8.

12. Savant R., Banerjee Kaushik, Utture S. C., Patil S. H., Ghaste, M. S. and Adsule P .G. 2010. Multiresidue analysis of 50 pesticides in grape, pomegranate and mango by gas chromatography – ion trap mass spectrometry. *J. Agric. Food Chem*. **58:** 1447-1454.

13. Sawant Indu S., Sawant S. D., Upadhyay Anuradha, Sharma J., Upadhyay A.K., Shetty D. and Bhirangi R. 2010. Crop loss in grapes due to downy mildew infection on clusters at pre- and post bloom stages under non-epiphytotic conditions. *Indian J. Hort*. **67:** 425-432.

14. Sawant S. D. and Sawant Indu S. 2010. Improving shelf life of grapes by pre-harvest treatment with *Trichoderma harzianum* 5R. *J. Eco-friendly Agriculture*, **5:** 179-182.

15. Somkuwar R. G., Satisha J. and Ramteke S. D. 2010. Effect of bunch load on berry growth in Tas-A-Ganesh grafted on different rootstocks. *Indian J. Hort*, **67(4):** 578-580.

16. Sawant S. D., Sawant Indu S., Shetty Dinesh, Shinde Manisha, Jade Sagar and Waghmare Monali. 2011. Control of powdery mildew in vineyards by Milastin K, a commercial formulation of *Bacillus subtilis* (KBTS). Journal of biological Control, **25:** 26-32.

17. Upadhyay, Anuradha, Kadam, U. S., Chacko, P. M. and Karibasappa G. S. 2010. Microsatellite and RAPD analysis of grape (Vitis spp.) accessions and identification of duplicates/misnomers in germplasm collection. *Indian Journal of Horticulture,* **67(1):** 8-15.

18. Upadhyay Anuradha, Kadam U. S., Chacko P. M., Aher L. and Karibasappa G. S. 201). Microsatellite analysis to differentiate clones of Thompson Seedless grapevine (*Vitis vinifera* L.). *Indian Journal of Horticulture,* **67(2)**: 260-263.

19. Wong J., Hao C, Zhang K., Yang P, Banerjee Kaushik, Hayward D., Iftakhar I, Schreiber A, Tech K., Sack C., Smoker M., Chen X., Utture S. C., Oulkar D. P. (2010). Development and interlaboratory validation of a QuEChERS-based liquid chromatography-tandem mass spectrometry method for multiresidue pesticide analysis. *J. Agric. Food Chem*. **58:** 5897-5903.

20. Wong J. W., Zhang K., Tech K, Hayward D. G., Krynitsky A. J., Cassias I, Schenck, F. J., Banerjee Kaushik, Dasgupta S., Brown D. (2010). Multiresidue Pesticide Analysis of Ginseng Powders Using Acetonitrile- or Acetone-Based Extraction, Solid-Phase Extraction Cleanup, and Gas Chromatography-Mass Spectrometry/Selective Ion Monitoring (GC-MS/SIM) or -Tandem Mass Spectrometry (GC-MS/MS). *J. Agric. Food Chem*. **58:** 5884-5896

21. Wong J. W., Zhang K., Tech K, Hayward D. G., Makovi C. M., Krynitsky A. J., Cassias I, Schenck, F. J., Banerjee Kaushik, Dasgupta S., Brown D. (2010). Multiresidue Pesticide Analysis in Fresh Produce by Capillary Gas Chromatography-Mass Spectrometry/Selective Ion Monitoring (GC-MS/SIM) and -Tandem Mass Spectrometry (GC-MS/MS). *J. Agric. Food Chem*. 2010, **58:** 5868-5883.

Papers Presented at Symposia / Workshops / Meetings

1. Aher L. B., Upadhyay Anuradha and Karibasappa G. S. 2011. Microsatellite markers to ascertain the genetic identity of wine grape varieties in Indian grape germplasm repository. Poster paper presented at National Symposium on recent trend in life sciences held at Shivaji University, Kolhapur during 4-5th March 2011. Abs no. GMB-4, pp. 53.

2. Keith R. Striegler, Satisha Jogaiah and John R. Clark., 2010. Response of Jupiter grapevine to shoot and cluster thinning. In 35th Annual American Society of Enology and Viticulture- Eastern Section from 12-15th July 2010 held at Hobart and William Smith Colleges, New York, USA.

3. Sawant Indu S., Karibasappa G. S., Deokar Kiran P., Shetty Dinesh and Upadhyay Anuradha. 2010. Evaluation of downy mildew resistance in grape accessions under tropical humid conditions of peninsular India. In. 4th Indian Horticulture Congress 2010, 18-21st November, 2010, New Delhi, India.

4. Sawant Indu S., Upadhyay Anuradha, Narkar Shubhangi, Shetty Dinesh, Sawant S. D. and Chowdappa P. 2010. Emergence of *Colletotrichum gloeosporoides* as the dominant pathogen of anthracnose disease of grapes. In 'National Symposium on Molecular Approaches for Management of Fungal Diseases of Crop Plants' 27-30th December 2010, IIHR, Bangalore.

5. Sawant S. D., Shetty Dinesh, Narkar Shubhangi, Waghmare Monali and Sawant Indu S. 2011. Effect of Grapevine Leafroll Associated Virus-3 on quality parameters of wine grape cv. Cabernet

Sauvignon. In. UGC-SAP sponsored National Symposium on recent trends in life Sciences, March 4-5th 2011 at Shivaji University, Kolhapur.

6. Sawant S. D. and Adsule P. G. 2011. Demonstration of an effective management of downy mildew under adverse conditions using location specific weather forecast. Lead paper presented in 9th National Symposium on "Crop Health Management for Sustainable Agri-horticultural Cropping System" held at CARI, Port Blair during February 17-19th, 2011.

7. Sharma Ajay Kumar, Adsule P. G., Sawant S. D. and Taware P. B. 2010. Yeast strains affect the dynamics of changes in TTA, reducing sugars, total phenolics and anthocyanins during fermentation of Cabernet Sauvignon wine grapes. Poster presented in National Conference on "Horticultural biodiversity for livelihood, economic development and health care" organized by Lt. Amit Singh Memorial Foundation and University of Horticultural Sciences, at Bangalore during 29-31st May 2010. Abstracts, p 126.

8. Sharma Ajay Kumar, Banerjee K. and Adsule P. G. 2010. Safety issues in fresh fruits and vegetables. Poster presented in National Conference on "Horticultural biodiversity for livelihood, economic development and health care" organized by Lt. Amit Singh Memorial Foundation and University of Horticultural Sciences, at Bangalore during 29-31st May 2010. Abstracts, p 135.

9. Sharma J., Upadhyay A. K. and Adsule P. G. 2010. Nutrient Dynamics in Grapes. at NRC on Citrus Nagpur, 26-27th September 2010.

10. Shinde M. P., Aher L. B., Upadhyay Anuradha and Karibasappa G. S. 2011. AFLP marker to differentiate clone of grapevine (*Vitis vinifera* L.) cv. Centennial Seedless. Oral presentation in National seminar on Frontiers in Biotechnology and bioinformatics held on 12th February 2011 at Dr. D.Y. Patil Biotechnology and Bioinformatics Institute, Pune. Abs no. OPT-06, pp 10.

11. Shinde P., Upadhyay Anuradha and Kamble A. 2011. Gene expression analysis of grape rootstock in response to draught and salinity stress. Poster paper presented at "National Seminar on Plant Biodiversity for Sustainable Development" held on 10-12th March 2011 at University of Pune, Pune.

12. Singh P. N., Sharma Ajay Kumar and Adsule P. G. 2010. Dynamics of antioxidants during grape fermentation as influenced by yeast strains. Poster was presented in 4th Indian Horticulture Congress organized by Horticultural Society of India and National skills Foundation of India at New Delhi from 18-21st November 2010. Book of Abstracts (Poster Papers) p 421.

Technical Bulletins

1. Sawant Indu S. and Sawant S. D. 2010. Anthracnose of Grapes. Technical Bullettin - ORP on Leaf spot diseases Series 8. Pp. 14.

Edited Work

Symposium proceedings

1. Proceedings of the Symposium on Advances in Vineyard Pest Management. (ed: R. Keith Striegler, Andy Allen, Satisha Jogaiah and Jackie Harris). Midwest Grape and Wine Conference, Held at Osage Beach, MO on February 6-8, 2010. Pp. 88.

Book Chapters

Karibasappa G. S. 2010. Grapes in India. In: *Biodiversity in Horticultural Crops* Vol. 2. Ed. K.V. Peter Pp. 189-201. Daya Publishing House, Delhi.

Upadhyay Anuradha. 2010. Grape. In: Advances in Horticultural Biotechnology, Molecular markers and Marker Assisted Selection Vol. III: Fruit crops, Plantation crops and Spices. Eds. H.P. Singh, V. A. Parthasarathy and K. Nirmal Babu. Pp. 125-142. Westville Publishing House, New Delhi.

Institutional Publications

Adsule P. G. and Upadhyay Anuradha (eds.). 2010. Annual Report 2009-10, National Research Centre for Grapes, Pune. Pp. 66.

Upadhyay Anuradha and Adsule P. G. (eds.) (2010). Grape News Vol. 13(2). National Research Center for Grapes, Pune, Pp. 4.

Upadhyay Anuradha and Adsule P. G. (eds.) (2010). Grape News Vol. 14(1). National Research Center for Grapes, Pune, Pp. 4.

Adsule P. G., Sawant Indu S. and Satisha J. (eds.) 2010. Package of practices for production of exportable table grapes. National Research Center for Grapes, Pune, Pp. 42.

Video CD

1. Upadhyay A. K., Sharma J. and Taware P. B. 2010. Video CD on 'Nutrient and Water Management in Grapes. Produced jointly by Agro India and NRC Grapes.

2. Sawant S. D. 2010. Video CD on 'Disease Management in Grapes Part 1'. Produced jointly by Agro India and NRC Grapes.

3. Somkuwar R. G. and Ramteke S. D., 2010. Video CD on 'Production of Exportable Grapes - Canopy Management and Judicious use of Bio-regulators'. Produced jointly by Agro India and NRC Grapes.

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

Research Advisory Committee (RAC) Meeting

Following are the members of RAC :

1.	Dr. S. D. Shikhamany, Former Vice-Chancellor, APHU, Hyderabad	Chairman
2.	Dr. B. Satyanarayana Reddy, College of Horticulture, Mudigere, Chikmagalur Dist., Karnataka	Member
3.	Dr. P. M. Haldankar, Professor (Hort.), Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli	Member
4.	Dr. N. Kumar, Dean (Horticulture), Tamil Nadu Agricultural University, Coimbatore	Member
5.	Dr. Neeraj Agrawal, Vice-President – Vineyards, Samant Soma Wines Ltd, Nasik	Member
6.	Dr. Prem Dureja, Emeritus Scientist, Indian Agricultural Research Institute, New Delhi	Member
7.	Dr. S. Rajan, Assistant Director General (Hort.-I), Indian Council of Agricultural Research, New Delhi	Member
8.	Dr. P. G. Adsule, Director, NRC for Grapes, Pune	Member
9.	Mr. Mahendra Shahir, President, Maharashtra State Grape Growers' Association, Pune	Member
10.	Mr. Rajeev Samant, CEO – Sula Vineyards, Nasik Vintress Pvt. Ltd, Mumbai	Member
11.	Dr. G. S. Karibasappa, Pr. Scientist (Hort.), NRC for Grapes, Pune	Member Secretary

The thirteenth meeting of the Research Advisory Committee was held on 28-29th March 2011 under the chairmanship of Dr. S. D. Shikhamany, former Vice-Chancellor, Andhra Pradesh Horticultural University. The Committee visited the experimental vineyards and laboratories on 28th March. The Committee reviewed the progress of ongoing research projects along with the action taken report on the recommendations of previous RAC and gave suggestions and recommendations for strengthening of ongoing research at the Centre.

Institute Research Committee Meeting

The 15th meeting of Institute Research Committee was convened on 6th and 8th July 2010 under the Chairmanship of Dr. P. G. Adsule, Director. Annual progress of ongoing projects and action taken on the points raised by the previous IRC, RAC were presented and deliberated by the members. The mid-term Institute Research Committee meeting was held on 12-13th January 2011 under the Chairmanship of Dr. P. G. Adsule, Director. Scientists presented the progress of ongoing research projects. The Chairman reviewed the research work and offered valuable suggestions.

Institute Management Committee (IMC) Meeting

The following are the members of IMC :

1.	Dr. P. G. Adsule, Director, NRC for Grapes, Pune	Chairman
2.	Dr. Indu S. Sawant, Principal Scientist (Plant Pathology), NRC for Grapes, Pune	Member
3.	Dr. M. Prabhakar, Principal Scientist (Agronomy), Indian Institute of Horticultural Research, Bangalore	Member
4.	Dr. Zote, Head, IARI, Regional Station, Pune	Member
5.	Dr. Anand Kumar Singh, Head, Division of Fruit and Horticultural Technology, Indian Agricultural Research Institute, New Delhi	Member
6.	Assistant Director General (Hort.-I), Indian Council of Agricultural Research, New Delhi	Member
7.	The Director of Horticulture, Commissionerate of Agriculture, Pune	Member
8.	Commissioner of Horticulture, Govt. of Andhra Pradesh, Hyderabad	Member
9.	Associate Director of Research, NARP Plain Zone, RFRS, Ganeshkhind, Pune	Member
10.	Mr. Mahendra Shahir, President, Maharashtra State Grape Growers' Association, Pune	Member
11.	Mr. Rajeev Samant, CEO – Sula Vineyards, Nasik Vintress Pvt. Ltd, Mumbai	Member
12.	Chief Finance and Accounts Officer, Central Institute of Fisheries Education, Mumbai	Member
13.	Administrative Officer, NRC for Grapes, Pune	Member Secretary

The 28th meeting of IMC was held on 18th March 2011 under the Chairmanship of Dr. P. G. Adsule, Director. Dr. G. S. Karibasappa made a presentation on grape hybrids developed at the Centre and presently are under evaluation for table, wine and juice purpose. The members suggested adaptive performance/demonstration trial for these hybrids. The Committee was appraised of the progress of the Residue Monitoring Programme during grape season of 2011. The Concept Note for XII Plan was also placed before the Committee.

Felicitation of innovative farmers

First time an Innovators Meet was organized on 18th January 2011, on the occasion of the Foundation Day of this institute. Seven innovative farmers were identified by the institute scientists based on their field experience. These farmers were invited for the meet to share about their innovative technologies developed and how they implemented in their farms. The invited farmers were viz. Mr. Tukaram M. Yalale (Latur), Dr. Vasant B. Dagade (Indapur), Mr. Somnath S. Tidake (Dindori, Nasik), Mr. Prakash Bafna (Pune), Mr. Nagesh S. (Khanpur, Sangli), Mr. Manoj Jadhav (Nasik), and Mr. Baburao Kabade (Miraj, Sangli).

The programme was presided over by Dr. P. G. Adsule, Director of the institute. In the beginning Dr. Indu S. Sawant, Principal Scientist (Plant Pathology) and In-charge Technical Cell highlighted the objectives of the programme. The innovative farmers were felicitated for their contribution to the grape industry by Dr. P. G. Adsule, Director and further, he highlighted different problems of grape growing and processing in India and thanked the innovators for sharing their experiences with scientists. The meet ended with a vote of thanks by Dr. G. S. Karibasappa, Principal Scientist. This programme was coordinated by Dr. A. K. Sharma, Senior Scientist.

Visit of the Parliamentary Standing Committee on Commerce

A Parliamentary team comprising of 11 members from Rajya Sabha and associated officials from the Rajya Sabha Secretariat, APEDA, and Government of Maharashtra visited the NRC Grapes on 2nd February 2011. The Committee was chaired by Shri Shanta Kumar, ex-Chief Minister, Himachal Pradesh and presently a member of Rajya Sabha.

In the beginning, Dr P. G. Adsule, Director, NRC Grapes welcomed and felicitated all the delegates. He gave a brief presentation on the establishment of the NRC Grapes and evolution of the National Referral Laboratory (NRL) at NRC Grapes that has facilitated the export of table grapes from India to the EU countries to a significant extent. He added that since the established of NRL in 2003-2004, there is an overall improvement in quality and price realization of the exported table grapes from India to Europe. The percentage of failed samples has reduced significantly from 23.68% in 2003-2004 to 3-7%, which is stabilized over last three grape seasons. The residue monitoring program has also created a good impact on the quality of the produce for domestic consumption in terms of the quality compliance of table grapes to the PFA and Agmark standards. Mr. Dave, Director APEDA substantiated Dr. Adsule's deliberations and informed the committee about the steps that APEDA has taken for overall implementation over the last seven years including upgradation of the facilities at NRL and different nominated laboratories.

Directors of NRC for Grapes and APEDA answered the queries of the honorable members of Rajya Sabha and informed that currently the scope of the NRL has been expanded to cover all the horticultural commodities. Director, APEDA also assured the support to upgrade the laboratories in other States in terms of infrastructure facilities and technical guidance.

Honorable Mr. Shanta Kumar, in his Chairman's address appreciated the efforts of the NRL under the NRC for Grapes and urged that similar success stories should be implemented in other commodities to establish a foolproof food safety system to instill confidence in the consumer regarding quality of fruits and vegetables during last seven years. The committee was then taken to the NRL building to show the facilities, which received wide appreciations from the esteemed members. The meeting ended with Vote of Thanks to the Honorable members of the Parliamentary Committee.

Consultancy, Patents and Commercialization of Technology

Eighteen consultancy programmes on different aspects of grape cultivation and were undertaken during the year. The consultancy was provided to the following organizations:

1. Human Service Foundation
2. M/s Deepak Fertilizers and Petrochemicals Corp. Ltd
3. M/s APMC
4. Sumitomo Chemical India Pvt. Ltd.
5. Austenitic Steels Private Limited
6. M/s Bayer (India) Limited
7. M/s Mosaic Fertilizers
8. M/s Nagarjuna Agrichem Limited
9. M/s Amaya Foods
10. M/s Privi Pharma Ltd.
11. M/s Syngenta India Limited
12. M/s SSS
13. M/s E.I. DuPont India Ltd.

Distribution of planting material under MTA

Plant material comprising of rootstocks like Dogridge (3.53 Lakhs), 110R (8345) and Ramsey (150) and grafted varieties like Thompson Seedless and Red Globe (547), Own rooted varieties (351), and cuttings (2860) were distributed to various states of the country viz. Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, Jammu & Kashmir, Punjab and Gujarat.

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.

International Seminars / Symposia / Conferences

Dr. P. G. Adsule, Director and Dr. K. Banerjee undertook study visit to Strasbourg of France and Dortmund of Germany during 18-30th June 2010. They participated in the European Pesticide Residue Workshop (EPRW 2010) in Strasbourg, France. They also visited BASF, Limburgerhof, and Institute of Environmental Research (INFU), University of Dortmund in Germany. Subsequently they also undertook study visit to USA during 17-29th July 2010 to participate in the 47th Florida Pesticide Workshop, St. Pete Beach, Tampa, Florida. They also visited Citrus Research and Education Centre (CREC) at Lake Alfred under University of Florida (UF) and Research and Development Centre of MS Monsanto at St. Louis in Missouri.

National Seminars / Symposia / Conferences

Name of the scientists	Title of Seminars / Symposia / Conferences	Period	Organizer and place
Dr. A. K. Sharma	National Conference on "Horticultural Biodiversity for Livelihood, Economic Development and Health Care"	29-31st May 2010.	Lt. Amit Singh Memorial Foundation and University of Horticultural Sciences, at Bangalore
Dr. P. G. Adsule	Directors' Conference	15-16th July 2010	ICAR at New Delhi
Dr. P. G. Adsule, Dr. Indu S. Sawant Dr. A. K. Sharma	Fourth Indian Horticulture Congress 2010	18-21st November 2010	Horticultural Society of India and National Skills Foundation of India at New Delhi
Dr. P. G. Adsule, Dr. S. D. Sawant Dr. R. G. Somkuwar	28th National Conference of All India Kisan Sabha and presented 'the role of ICAR in transferring of technologies to KVKs, State Dept. of Agriculture Extension, SAUs.	11th December 2010	All India Kisan Sabha at Aurangabad
Dr. Indu S. Sawant	National Symposium on Molecular Approaches for Management of Fungal Diseases of Crop Plants	27-30th December 2010	IIHR at Bangalore
Dr. P. G. Adsule	Conference on Agrochemicals-2011	11th February 2011	FICCI, Dept. of Chemicals and Petrochemicals, Govt. of India at Mumbai
Dr. Indu S. Sawant	X Agricultural Science Congress	10-12 February 2011	NBFGR at Lucknow
Dr. S. D. Sawant	9th National Symposium on "Crop Health Management for Sustainable Agri-horticultural Cropping System"	17-19th February 2011	ICAR, New Delhi; CARI, Port Blair and Society of Plant Protection Sciences, New Delhi at CARI, Port Blair

Workshops / Meetings

Name of the scientists	Title of meeting	Duration	Organizer and place
Dr. Anuradha Upadhyay	DBT taskforce meeting	18th May 2010	DBT at New Delhi
Dr. P. G. Adsule	Planning Commission meeting	1-2nd July 2010	Planning Commission at New Delhi
Dr. Anuradha Upadhyay	Consultative Meet on Biotechnology Research in ICAR	26-27th July 2010	NRCPB at New Delhi
Dr. A. K. Upadhyay	Meeting for updation and review of RMP.	17th July 2010	NRC Grapes and APEDA at Pune
Dr. A. K. Upadhyay	Core Committee meeting to finalize Residue Monitoring Plan on Grape	22nd July 2010	APEDA at New Delhi
Dr. P. G. Adsule and Dr. A. K. Upadhyay	Interactive meeting of all exporters of the country organized to finalize action plan of Indian stake holders to the EU laboratories and their importers regarding unethical practices followed thereby affecting the trade and India's reputation in the market.	1st August 2010	APEDA at New Delhi
Dr. P. G. Adsule, Dr. S. D. Sawant, Dr. A. K. Upadhyay, Dr. K. Banerjee, Dr. S. D. Ramteke, Dr. D. S. Yadav Mrs. S. Salini	Meeting for updation and review of RMP.	2nd and 6th August 2010	APEDA and NRC Grapes at Pune
Dr. P. G. Adsule	Meeting regarding Pesticide Residues in Exportable Vegetables from India	5th August 2010	APEDA at Mumbai
Dr. Anuradha Upadhyay	Partner's Meet on National Agriculture Bioinformatics Grid	7th August 2010	NBPGR at New Delhi
Dr. P. G. Adsule	Meeting in the area of monitoring of pesticide residue for agricultural crops particularly fruits and vegetable and also examination of Ph.D students in the area of standards of Indian wine and also visited few vineyards and grape processing unit in the way of Sangli and Kolhapur regio	11-12th August 2010	Shivaji University at Kolhapur

Name of the scientists	Title of meeting	Duration	Organizer and place
Dr. Indu S. Sawant	AMAAS annual meeting	17-18th August 2010	NBAIM at Mau Nath Bhanjan
Dr. P. G. Adsule	Meeting convened by the Additional Secretary, Ministry of Agriculture regarding Residue Monitoring Plan	20-21st August 2010	APEDA at New Delhi
Dr. P. G. Adsule	Meeting for approved use of pesticides in Agriculture crop meeting convened by Joint Secretary (Plant Protection), Ministry of Agriculture relating to filing of application to EU commission for raising MRL of CCC in exportable table grapes to EU market.	30th August – 1st September 2010	Plant Protection Advisor of Govt. of India, Ministry of Agriculture at New Delhi
Dr. A. K. Upadhyay	Interactive Meeting on Nutrient Dynamics in Horticultural Crops.	27-28th September 2010	NRC Citrus at Nagpur
Dr. S. D. Sawant Dr. Roshni R. Samarth	One day workshop for the Scientist, Farm Management Staff of NRCG, and progressive grape growers	25th October 2010	Dr. Graham Sanderson, Application Specialist of Global Application Team of Syngenta at Pune
Dr. G. S. Karibasappa Dr. A. K. Upadhyay Dr. S. D. Ramteke Dr. J. Satisha	Pre meet on research needs arising due to abiotic stresses in agriculture management on India under global climate change scenario	29-30th October 2010	National Institute of Abiotic Stress Management at Baramati
Dr. P. G. Adsule	Third meeting of Screening-cum-Implementation Group (SIG) on the Recommendations of the Report on "Secondary Agriculture: Value Addition to Primary Agriculture"	3rd November 2010	Planning Commission (Agriculture Division) at New Delhi
Dr. J. Satisha	Interactive meet on "Information and communication technology in ICAR	3-4th November 2010	IASRI at New Delhi
Dr. P. G. Adsule	Interactive meeting with Hon'ble DG, ICAR & Horticulture-Industry Meet	10th-11th November 2010	IIHR at Bangalore
Dr. A. K. Upadhyay	Meeting on pesticide residue monitoring in grapes, other crops and related issues on the residue monitoring plan.	12th November 2010	APEDA at New Delhi

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

Name of the scientists	Title of meeting	Duration	Organizer and place
Dr. P. G. Adsule	Meeting of Selection Committee for the recruitment of the post of Dean and Asst. Professor.	18th December 2010	Sardarkrushinagar Dantiwada Agricultural University at Sardarkrushinagar, Gujarat
Dr. P. G. Adsule	21st meeting of ICAR Regional Committee No. VII	2-4th December 2010	ICAR at CIAE, Bhopal
Dr. A. K. Upadhyay Dr. K. Banerjee	Meetings with nominated laboratories to finalize standard operating procedures for analysis of pesticide residue in grapes and educating them on the methodologies followed for reporting and sampling	13th August, 13th November, 4th December 2010	NRC for Grapes at Pune
Dr. P. G. Adsule	18th Meeting of the Board of Management as DG, ICAR's nominee	4th January 2011	Navsari Agricultural University, Navsari, Gujarat at Gandhinagar
Dr. P. G. Adsule	Meeting regarding the issues of grape industry in the State	5th January 2011	State Minister of Horticulture at Mantralaya, Mumbai
Dr. Indu S. Sawant	IMC Meeting	2nd February 2011	NRC for Citrus at Nagpur
Dr. P. G. Adsule	Meeting regarding organization of Wine Seminar in India and also discussion with the Italian delegation coming to this Institute on this occasion and presentation about wine education in India	8th February 2011	Gargi Agricultural Research and Training Institute (Asia's first wine technology institute in the country) at Nasik
Dr. P.G. Adsule	Meeting regarding use of various agro-chemicals.	14th February 2011	Shivaji University at Kolhapur
Dr. Indu S. Sawant	AMAAS Half Yearly Review Meeting	21st February 2011	NBAIM at Mau Nath Bhanjan
Dr. P. G. Adsule	Interface of ICAR Directors with the Vice-Chancellors of SAUS and Directors Conference	22-24th February 2011	DG, ICAR at New Delhi

Name of the scientists	Title of meeting	Duration	Organizer and place
Dr. P. G. Adsule Dr. G. S. Karibasappa	Meeting with the RAC Chairs. Gave the presentation about on-going research programmes and achievements and future thrust areas of XIIth Plan about the Institute.	9-10th March 2011	Secretary, DARE & DG, ICAR at New Delhi
Dr. J. Satisha	Sensitization workshop on development of Results – Framework Development (RFD)	11-14th March 2011	ADG (PIM) ICAR at New Delhi
Dr. P. G. Adsule, Dr. K. Banerjee Dr. A. K. Sharma	Various issues related with export of wines to EU like GI, Standards, methods of analysis were addressed. Preparation of draft on harmonization of analytical methods for wines was decided	16th March 2011	Director APEDA at New Delhi
Dr. Indu S. Sawant	Review meeting on 'ICAR-Out Reach Programme - "Diagnosis and management of leaf-spot diseases of horticultural and field crops'	29th December 2011	IIHR at Bangalore

Distinguished Visitors

- Dr. S. Ayyappan, Secretary, Department of Agricultural Research and Education and Director General, ICAR, New Delhi visited NRC Grapes, Pune on 28th October 2010. During the visit, he made a point to visit National Active Grape Germplasm Site, experimental vineyards, and different laboratories and other infrastructure of the Centre. During his meeting with scientists and staff he critically reviewed the achievements and the present research activities of the Centre and was very much appreciative of the work and suggested to focus more on basic and strategic research and have more active interaction and networking with experts within the country and abroad. He also urged the scientists to forge international cooperation and linkages and strive to bring Indian grape research to international arena. He advised to prioritise theme based multi-disciplinary research programmes to resolve specific issues concerning the grape sector in India and agreed to support the further infrastructural needs of the Centre in fulfilling its mandate. He also interacted with individual scientists and the staff of the Centre and solicited their opinions and grievances.
- Dr. S. B. Dandin, Hon'ble Vice Chancellor, University of Horticultural Sciences, Bagalkot, Karnataka on 7th October 2010.
- Dr. R. R. Hanchinal, Vice Chancellor, UAS Dharwad visited the Centre on 4th November 2010.
- An official delegation from the Embassy of the Kingdom of the Netherlands, New Delhi on 27th January 2011.
- Sh. G. C. Pati, Additional Secretary to Govt. of India on 15th February 2011 and reviewed the achievements of the NRL.
- Parliamentary Standing Committee on Commerce on 2nd February 2011 to review the activities of National Referral Laboratory. Shri Shanta Kumar, Former Chief Minister, Himachal Pradesh and Rajya Sabha Member was the Chairman of the Committee.
- Dr. H. P. Singh, DDG (Hort.), ICAR visited the Centre on 13th March 2011 to review the research activities of the Centre.

अनुसंधान एंव प्रबंधन कर्मचारी वर्ग

निदेशक

डॉ. पां. गु. अडसुले

फसल सुधार

डॉ. जी. एस. करीबसप्पा, प्रधान वैज्ञानिक (बागवानी)
डॉ. अनुराधा उपाध्याय, वरिष्ठ वैज्ञानिक (जैव प्रौद्योगिकी)
डॉ. रोशनी रा. समर्थ, वैज्ञानिक (जैव प्रौद्योगिकी)

फसल उत्पादन

डॉ. रा. गु. सोमकुंवर, प्रधान वैज्ञानिक (बागवानी)
डॉ. अजय कुमार उपाध्याय, वरिष्ठ वैज्ञानिक (मृदा विज्ञान)
डॉ. स. द. रामटेके, वरिष्ठ वैज्ञानिक (पादप शरीरक्रिया विज्ञान)
डॉ. ज. शर्मा, वरिष्ठ वैज्ञानिक (मृदा विज्ञान)
डॉ. जो. सतीशा, वरिष्ठ वैज्ञानिक (बागवानी)
डॉ. अ. कु. गोस्वामी, वरिष्ठ वैज्ञानिक (बागवानी)

फसल संरक्षण

डॉ. इन्दु सं. सावंत, प्रधान वैज्ञानिक (पादप रोग विज्ञान)
डॉ. संजय दी. सावंत, प्रधान वैज्ञानिक (पादप रोग विज्ञान)
डॉ. कौशिक बॅनर्जी, वरिष्ठ वैज्ञानिक (कृषि रसायन विज्ञान)
डॉ. दी. सिं. यादव, वैज्ञानिक (कीट विज्ञान)
श्रीमती एस्. शालिनी, वैज्ञानिक (कीट विज्ञान)

कटाई उपरान्त प्रौद्योगिकी

डॉ. अजय कुमार शर्मा, वरिष्ठ वैज्ञानिक (बागवानी)

कृषि अनुसंधान सूचना प्रणाली

श्रीमती कविता मुंदनकर, वैज्ञानिक वरिष्ठ पैमाना (कृषि में कम्प्यूटर प्रयोग)

प्रशासन एवं वित्त

श्री. ओ. बाबू, सहायक प्रशासनिक अधिकारी
श्री. बाबासाहेब मा. चव्हाण, वैयक्तिक सचिव एवं सहायक वित्त एवं लेखा अधिकारी (प्रभारी)

Infrastructure Development

Laboratory

During the period, equipments viz. programmable temperature, light, and RH controlled plant growth chamber, a temperature and light BOD incubator, a PCR machine and a –20°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	25	29
2.	Scientific journals	__	35	35

Other Activities

हिंदी प्रयोग से सम्बन्धित गतिविधियां

हिंदी में सरकारी कामकाज

संस्थान के कुछ अनुभागों जैसे वित्त, प्रक्षेत्र, तकनीकी, एरीस से जारी होने वाले पत्र एवं परिपत्र हिंदी अथवा द्विभाषी जारी किए जाते हैं। कुछ अनुभागों में फाइल में टिप्पणी हिंदी में लिखी जाती है।

हिंदी पखवाड़ा

संस्थान मे 14-30 सितंबर के दौरान हिंदी पखवाड़ा का आयोजन हुआ। विभिन्न प्रतियोगिताओं का आयोजन हुआ जिसमें सभी कर्मचारियों ने बढ़ चढ़ कर भाग लिया। 30 सितंबर को समापन दिवस पर मुख्य अतिथि श्री. गोपाल वर्मा, हिंदी अधिकारी (सी.डैक., पुणे) ने विजेताओं को पुरस्कार वितरित किए।

हिंदी कार्यशाला

संस्थान में दि. 30-9-2011 को हिंदी कार्यशाला का आयोजन किया गया। श्री. गोपाल वर्मा, हिंदी अधिकारी (सी.डैक., पुणे) ने हिंदी में श्रुतलेखन और हिंदी अनुवाद के लिए उपलब्ध विभिन्न सॉफ्टवेयर की जानकारी दी एवं उनका प्रदर्शन भी किया। विभिन्न प्रकार के फॉन्ट को यूनिकोड फॉन्ट में बदलने के तरीकों की भी जानकारी दी।

तिमाही प्रतिवेदन तथा बैठक

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

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

पत्रव्यवहार

संस्थान में प्राप्त हिंदी पत्रों का उत्तर केवल हिंदी में ही दिया जाता है । साथ ही साथ कुछ पत्रों के उत्तर द्विभाषी भी होते हैं । इस वर्ष संस्थान से 914 पत्र हिन्दी में प्रेषित किए गए ।

हिंदी पट्टिका

संस्थान के प्रवेश कक्ष में एक पट्टिक स्थापित की गयी है । जिसका प्रयोग हिंदी जानकारी के लिए किया जाता है । इस पर प्रतिदिन एक हिंदी शब्द लिखा जाता है तथा उसका अंग्रेजी में अनुवाद लिखा जाता है । इस पट्टिका पर दैनिक मौसम की जानकारी हिंदी में ही लिखी जाती है ।

कार्मिक

- श्री. एल. आर. गोपालकृष्णन (सहायक) भारतीय कृषि अनुसंधान परिषद के विभिन्न संस्थानों में 39 साल की सेवा के बाद 31 दिसम्बर 2010 को सेवानिवृत्त हुए। संस्थान के निदेशक एवं सभी कर्मचारी उनके सुखमय, स्वस्थ और सक्रिय जीवन की कामना करते हैं।
- डॉ. रोशनी रा. समर्थ ने 23 अप्रैल 2010 को वैज्ञानिक (पादप प्रजनन) के रुप में कार्य ग्रहण किया।
- डॉ. अ. कु. गोस्वामी ने 30 अप्रैल 2010 को वैज्ञानिक (बागवानी) के रुप में कार्य ग्रहण किया।

समारोह

स्वाधीनता दिवस

संस्थान में 15 अगस्त 2010 को स्वाधीनता दिवस हर्ष और उल्लास से मनाया गया । संस्थान के निदेशक डॉ. पां. गु. अडसुले ने ध्वजारोहन किया और संबोधन भाषण दिया। इस अवसर पर कर्मचारी कल्याण संघ ने कुछ कर्मचारियों के बच्चों को शैक्षणिक क्षेत्र में उनकी उत्कृष्ट उपलब्धि के लिए पुरस्कृत किया। देशभक्ति गीत गाकर और मिठाई बांट कर कार्यक्रम का समापन हुआ।

गणतंत्र दिवस

हर वर्ष की तरह इस वर्ष भी संस्थान में 26 जनवरी 2011 को देश का गणतंत्र दिवस सउल्लास मनाया गया। निदेशक, डॉ. पां. गु. अडसुले ने ध्वजारोहण किया और सभी कर्मचारियों ने राष्ट्रध्वज को सलामी दी।

संस्थान समिति

संस्थान में विभिन्न कार्यों जैसे तकनीकी, प्रकाशन, क्रय, प्रक्षेत्र प्रबंधन, पुस्तकालय, संपदा रखरखाव, खेल, एरिस कक्ष, राजभाषा एवं राजस्व उत्पादन आदि के सुचारु कार्यान्वयन के लिए अनेक समितियां गठित हैं। इसके अलावा परिषद के निर्देशानुसार विभिन्न उद्देश्यों जैसे सूचना अधिनियम, पी एम ई, मास मीडिया सम्पर्क, सांख्यिकीय विश्लेषण सोफ्टवेयर, मौसम परिवर्तन पर अनुसंधान आदि के लिये नोडल अधिकारी मनोनीत हैं।

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 2010	20.75	39.54	19.20	68.93	6.70	11.05	11.2	3	1
May 2010	23.76	38.75	27.06	75.71	8.14	11.13	10.0	7	1
Jun 2010	22.92	32.65	63.67	97.57	3.40	11.53	191.6	16	11
Jul 2010	22.45	29.38	75.26	99.35	2.38	11.37	106.4	23	6
Aug 2010	22.25	29.10	77.58	99.74	2.06	10.73	121.2	19	5
Sep 2010	21.23	31.39	70.70	100.00	2.50	9.47	42.0	14	2
Oct 2010	19.33	33.26	55.42	100.00	3.06	8.69	0.4	2	0
Nov 2010	18.77	31.94	59.90	100.00	1.72	8.43	0	0	0
Dec 2010	10.74	30.28	43.06	100.00	2.69	9.49	0.4	0.4	1
Jan 2011	9.24	32.27	30.10	98.55	3.50	9.82	0.2	1	0
Feb 2011	12.79	33.80	28.14	92.86	4.70	9.71	0.0	0	0
Mar 2011	15.94	37.20	18.94	75.29	6.57	10.89	0.6	1	0
Total	--	--	--	--	--	122.31	484.0	86.4	27

Source : Weather station, NRC for Grapes, Pune

* No irrigation required on days with more than 4 mm rain.

Abbreviations

AOAC	:	Association of Official Analytical Chemist
AAS	:	Automatic Absorption Spectrophotometer
AFLP	:	Amplified Fragment Length Polymorphism
AMAAS	:	Application of Microorganisms in Agriculture and Allied Sector
APEDA	:	Processed Food Products Export Development Authority
APHU	:	Andhra Pradesh Horticultural University
ARI	:	Agharkar Research Institute
ARIS	:	Agricultural Research Information System
AWS	:	Automatic Weather Station
BA	:	Bankui Abhyad
BAR	:	Bhabha Atomic Research Centre
BOD	:	Biological Oxygen Demand
BRNS	:	Board of Research in Nuclear Sciences
CARI	:	Central Agricultural Research Institute
CCC	:	Chlormequat Chloride
CD	:	Critical Difference
CISH	:	Central Institute of Subtropical Horticulture
CIAE	:	Central Institute of Agricultural Engineering
CREC	:	Citrus Research and Education Centre
CPPU	:	N-(2-chloro-4-pyridyl)-N'-phenyl urea
CV	:	Coefficient of Variability
DARE	:	Department of Agricultural Research and Education
DBT	:	Department of Biotechnology
DDG	:	Deputy Director General
DDRT-PCR	:	Differential Display of Reverse Transcription-Polymerase Chain Reaction
EC	:	Electrical Conductivity
ELISA	:	Enzyme-Linked ImmunoSorbent Assay
EPRW	:	European Pesticide Residue Workshop
FICCI	:	Federation of Indian Chambers of Commerce and Industry,
FOCARS	:	Foundation Course for Agricultural Research Service
FRP	:	Fiberglass Reinforced Plastic
GA3	:	Gibberellic Acid
GAP	:	Good Agricultural Practices
GC	:	Gas Chromatography
GC-TOFMS	:	Gas Chromatography -Time-Of-Flight Mass Spectrometry
GLRaV	:	Grape Leaf Roll associated Virus
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
INFU	:	Institute of Environmental Research
IPM	:	Integrated Pest Management
IRGA	:	Infra-Red Gas Analyser
IRGS	:	Internal Revenue Generation Scheme
ITMU	:	Institute Technology Management Unit
KVK	:	Krishi Vigyan Kendra
LOD	:	Limit of Detection
MRDBS	:	Maharashtra Rajya Draksh Bagaitdar Sangh
MRL	:	Maximum Residue Limit
NAA	:	Naphthalene Acetic Acid
NAARM	:	National Academy of Agricultural Research Management
NAIP	:	National Agricultural Innovation Project
NASC	:	National Agriculture Science Centre
NBAII	:	National Bureau of Agriculturally Important Insects
NBFGR	:	National Bureau of Fish Genetic Resources
NBPGR	:	National Bureau of Plant Genetic Resources
NHB	:	National Horticulture Board
NHRDF	:	National Horticulture Research and Development Foundation
NRCPB	:	National Research Centre on Plant Biotechnology
NRL	:	National Referral Laboratory
PAH	:	Polyaromatic Hydrocarbons
PCA	:	Principal Coordinate Analysis
PCB	:	Polychlorinated biphenyls
PCR	:	Polymerase Chain Reaction
PDI	:	Per cent Disease Index
PHI	:	Post Harvest Interval
PME	:	Project Management and Evaluation
PPO	:	Polyphenol Oxidase
PT	:	Proficiency Test
QRT	:	Quinquennial Review Team
RAC	:	Research Advisory Committee
RFD	:	Results – Framework Development
RH	:	Relative Humidity
RMP	:	Residue Monitoring Plan
SAU	:	State Agricultural University
SC	:	Soluble Concentrate
TSS	:	Total Soluble Solids
TTA	:	Total Tartaric Acid
UPLC	:	Ultra Performance Liquid Chromatography
WG	:	Wettable Granule
WP	:	Wettable Powder
ZTM-BPD	:	Zonal Technology Management – Business Planning and Development
TCA	:	2,4,6-trichloroanisole