वार्षिक प्रतिवेदन

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2003-2004

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(भारतीय कृषि अनुसंधान परिषद)

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NATIONAL RESEARCH CENTRE FOR GRAPES

(Indian Council of Agricultural Research)

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PREFACE

The Centre has completed just seven years since its inception in 1997. The initial two years were spent on formative stages of land acquisition, recruitment of staff and creation of basic facilities for the working of the Centre. The construction of the main building initiated in 2000 was completed in all respects only in 2002. During 2002-04, the emphasis was given on the creation of research facilities particularly equipments, instruments, tools and infrastructure facilities including furniture for all the laboratories. Further strengthening of infrastructure is still continuing. During the period of the report, land development was continued particularly strengthening of irrigation facilities by desilting of existing wells on the farm and getting water from the nearby premises of the Agriculture University in view of the serious drought for last two years. Planting of newly introduced varieties under the APEDA and NATP scheme was completed. Pesticide residue monitoring in fresh grapes was the significant activity at the Centre in view of the rejection of grape consignments in European market in 2003 season. A proposal mooted by the APEDA for setting up the National Referral Laboratory at this Centre to monitor the pesticide residues was accepted and work in this respect initiated on war footing. The scientists were trained abroad to abreast with the high-tech and sensitive instruments and methodologies followed in European Union countries. Action was initiated to procure high-tech equipments. A Pesticide Residue Monitoring Plan prepared by the APEDA for 2003-04 was implemented successfully. As a result, this season, there was no alert notice by the EU Commission to the Indian Government for the high pesticide residue in Indian grapes.

Ongoing research programmes in the area of crop improvement, crop production, crop protection and post-harvest technology in case of table grapes were continued. Besides, a few new research programmes particularly on wine grapes were initiated in collaboration with M/s Indage Winery at Narayangaon after due deliberations in the Staff Research Council meeting in view of the changing needs of the Indian viticulture.

Transfer of technology in the form of visits to farms / processing units in various grape growing states besides the supply of quality plant material of scion varieties and rootstock was undertaken. Further, the scientists of the Centre participated in the Annual Seminar and the local area workshops organized by the respective State Government and their Grape Growers' Associations and guided the grape growers and State Extension Officials on important facets of viticulture.

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

I would like to place on record the guidance and the encouragement received from Dr. Mangala Rai, Secretary, DARE and Director General, ICAR and Dr. Gautam Kalloo, Dy. Director General (CS and Hort.) during the period. I also appreciate the efforts and help received from my scientific staff members in the preparation of this document.

Place : Pune
Date : September 2004

(P.G. ADSULE)
Director

पुणे स्थित राष्ट्रीय अंगूर अनुसंधान केन्द्र की स्थापना सन् १९९७ ई. में हुई। केन्द्र में लक्ष्य आधारित कार्यक्रमों के अन्तर्गत मौलिक और सामरिक महत्व के अनुसंधान द्वारा अंगूर उत्पाद, उत्पादन क्षमता और उपयोग को प्रभावित करने वाले जैविक तथा अजैविक कारकों के समाधान के लिए प्रयास किये जा रहे हैं। इन लक्ष्यों की प्राप्ति के लिए फसल सुधार, फसल उत्पादन, फसल संरक्षण और कटाई उपरान्त प्रौद्योगिकी के क्षेत्र में अनुसंधान प्रगति पर है।

अपनी स्थापना के सातवें वर्ष में ही, केन्द्र को विभिन्न एजेंसी से मान्यता मिली है और इन एजेंसी ने कई अनुसंधान परियोजनाओं को आर्थिक सहायता प्रदान की है। एपीडा ने अंगूर उत्पादकों के कल्याण और अंगूर उद्योग की मजबूती के लिए केन्द्र द्वारा किये गये प्रयासों को अभीस्वीकृत किया और इस केन्द्र को भारत से निर्यात होने वाले अंगूरों में कीटनाशी अवशिष्टों के अनुवीक्षण के लिए स्थापित राष्ट्रीय रेफरल प्रयोगाला के रूप में मान्यता दी।

केन्द्र में मुख्यत: १२ संस्थान परियोजनाओं के अन्तर्गत अनुसंधान चल रहा है। यह परियोजनाएँ अंगूर किसानों की आवश्यकताओं को ध्यान में रखकर प्रारम्भ की गयीं तथा समय-समय पर अनुसंधान सलाहकार समिति और स्टाफ अनुसंधान परिषद की सिफारिशों के आधार पर रुपान्तरित की जाती हैं। इनके अलावा दो डी.बी.टी., २ एन.ए.टी.पी., दो एपीडा और कई अनुबन्धित परियोजनाओं के अन्तर्गत भी अनुसंधान कार्य किया गया। वर्ष के दौरान विभिन्न क्षेत्रों में हुई उपलब्धियों का सार निम्न है।

फसल सुधार

देश के विभिन्न भागों से २७ और दूसरे देशों से ६ नई प्रविष्ठियों को जननद्रव्य संग्रह में सम्मिलित किया गया। दूसरी ओर बाह्यरुप गुणों और पत्ती संरचना गुण अध्ययनों के आधार पर २२ प्रविष्ठियाँ समगुण पायी गयीं। अत: उन्हें जननद्रव्य संग्रह से निकाल दिया गया। व्यापारिक किस्मों से उत्प्रेरित प्रजातियों के व्यापारिक मूल्य का विस्तृत अध्ययन किया गया। प्रजजन के लिए उपयोगी कुछ निपुंसक प्रविष्ठियों की पहचान की गयी।

अंगूर जननद्रव्य सूचना पद्धति के अन्तर्गत विभिन्न कार्यों जैसे तथ्य डालना, निकालना, इत्यादि के लिए फॉर्म जोड़े गये।

डाउनी मिल्ड्यू से सम्बन्धित 'आण्विक मार्कर' की पहचान के लिए अनुसंधान गहन किया गया। थॉमसन सीडलैस और फ्लेम सीडलैस संवेदनशील किस्म तथा प्रतिरोधी किस्मों 'सीबल' तथा 'सेवी वीलार्ड' के बीच संकरण किया गया। इस समय ७४ एफ़१ सन्ततियाँ उपलब्ध हैं। उपलब्ध सूचना के आधार पर अनेक संवेदनशील और प्रतिरोधी प्रविष्ठियों का अध्ययन के लिए चयन किया गया और इनकी पत्तियों से डीएनए निकाला गया। ए.एफ.एल.पी. और एस.एस.आर. विश्लेषण विधि का मानकीकरण किया गया। कुछ उपयोगी ए.एफ.एल.पी. प्राइमर की पहचान की गयी। चयनित संवेदनशील और प्रतिरोधी किस्मों को पत्ती डिस्क विधि द्वारा *प्लाजमोपेरा विटिकोला* के विरुद्ध जाँचा गया तथा १-९ के स्केल पर वर्गीकृत किया गया।

फसल उत्पाद

ताश-ए-गणेश किस्म की अन्य मूलकांडों के मुकाबले ११० आर पर अच्छी वृद्धि पायी गयी। इस किस्म में पश्च छँटनी के बाद ३५ शाखाएँ और अग्र छँटनी के बाद ४० गुच्छे अवधारण से उच्च उपज, मणि वजन एवं व्यास मिला। छँटनी के ६० या ७५ दिन के बाद गर्डलिंग से शरद सीडलैस में उच्च मणि वजन और व्यास तथा उपज प्राप्त हुई। इस किस्म में ४० गुच्छे प्रति बेल अवधारण से अच्छी गुणवत्ता एवं उपज मिली।

डॉगरिज मूलकांड पर कलम किए थॉमसन सीडलैस में दूसरे मूलकांडों के मुकाबले अधिक गुच्छा वजन, मणि लम्बाई और व्यास पाया गया। इस मूलकांड पर उगाये अंगूरों की शेल्फ लाइफ दूसरे मूलकांडों पर उगाये अंगूरों से बेहतर थी।

दस से अधिक पत्ती वाले गुच्छे पर सीपीपीयू के प्रयोग से अंगूर की गुणवत्ता में सुधार हुआ। पीएच ३.०-६.० पर फॉस्फोरिक अम्ल और यूरिया फॉस्फेट जैसे सहायक के इस्तेमाल से जिबरेलिक अम्ल की कार्यकुशलता में बढ़ोत्तरी हुई।

३-४ मिमी तथा ६-७ मिमी मणि आकार अवस्था पर क्रमश: ४० और ३० पीपीएम जिबरेलिक अम्ल तथा १० पीपीएम ६-बीए के इस्तेमाल से शरद सीडलैस की गुणवत्ता में सुधार हुआ।

फर्टिगेशन के प्रयोगों में पूर्व वर्षों के परिणामों की पुष्टि हुई अर्थात वृद्धि अवस्था अनुसार ड्रिप द्वारा पोषण देने से ६० प्रतिशत तक बचत की जा सकती है। लवणीय और अपर्याप्त पानी की परिस्थितियों में उपज बनाए रखने में मूलकांड उपयोगी सिद्ध हुए और पानी की सिफारिश मात्रा के ५० और ७५ प्रतिशत स्तर पर भी उच्च उपज प्राप्त हुई। इसी प्रकार मल्च और एन्टीस्ट्रेस के प्रयोग से ७५ प्रतिशत स्तर पर सिफारिश मात्रा के बराबर ही उपज प्राप्त हुई अर्थात् पानी की मात्रा

में २५ प्रतिशत बचत हुई। एक दूसरे प्रयोग में, उपतलीय सिंचाई विधि से भी २५ प्रतिशत सिंचाई पानी की बचत हुई।

फसल संरक्षण

पाउडरी मिल्ड्यू के प्रबन्ध के लिए, बीमारी की भविष्यवाणी मॉडल के प्रयोग में फलन मौसम में चार छिड़कावों की बचत हुई। ०.५ प्रतिशत पोटॅशियम बाई कार्बोनेट तथा ०.०५ प्रतिशत हेक्ज़ाकोनाज़ोल का प्रयोग पाउडरी मिल्ड्यू के बेहतर प्रबन्धन के लिए उपयुक्त पाया गया। काइटोसान का एकक अथवा *ट्राइकोडर्मा* और *वर्टिसिलियम* के साथ अथवा पोटॅशियम डाइहाड्रोजन फॉस्फेट के साथ प्रयोग करने से पाउडरी मिल्ड्यू में कमी पायी गयी। प्रारम्भिक प्रयोगों में अरूढ़िगत विधियाँ जैसे गोमुत्र, दूध, पोटॅशियम डाइहाड्रोजन फॉस्फेट एवं एज़ाडिरेक्टिन पाउडरी मिल्ड्यू की रोकथाम में प्रभावाशली रहीं।

देश में अंगूर खेती वाले विभिन्न क्षेत्रों में प्रमुख परजीवी कीटों के मौसमी आपात के सर्वेक्षण में नवम्बर से फरवरी के दौरान, थ्रीप, जॅसिड्स और मीलीबग की संख्या आर्थिक अवसीमा स्तर से अधिक पायी गयी। परजीवी कीटों के मौसमी आपात और मौसम अवस्था में सहसम्बन्ध स्थापित करने का प्रयास किया गया। अंगूर उत्पादकों द्वारा परजीवी कीटों के नियंत्रण के लिए इस्तेमाल होने वाली देशी विधियों का प्रलेखन करने के लिए सर्वेक्षण किया गया। देशी विधियों में विभिन्न भौतिक, जैविक, मशीनी, रसायनिक विधियाँ पायी गयी। विभिन्न प्रजातियों / किस्मों का विभिन्न परजीवी कीटों के प्रति संवेदनशीलता/ प्रतिरोधता का आँकलन करने के लिए जननद्रव्य संग्रह की छानबीन की गयी।

काइटोसान @ १.० ग्रा./लिटर का उपयोग कटाई से २० और ७ दिन पहले करने और अंगूरों को ३.५ ग्रा. सोडियम मेटाबाइसल्फाइट के साथ पैक करने से शीतरक्षित अंगूरों की शेल्फ लाइफ में ४ दिन की बढ़ोत्तरी हुई।

प्रौद्योगिकी और सूचना स्थानान्तरण

प्रशिक्षण कार्यक्रम, प्रक्षेत्र दर्शन, सेमिनार और अंगूर उत्पादकों के साथ पारस्परिक बातचीत द्वारा प्रौद्योगिकी और सूचना स्थानान्तरण, इस केन्द्र का एक महत्वपूर्ण और अविभाज्य कार्यकलाप है। एकीकृत रोग प्रबन्ध एवं उष्णकटिबंधी क्षेत्रों में अंगूर उत्पादन में उन्नति विषयों पर आयोजित प्रशिक्षण कार्यक्रमों को बहुत सराहना मिली। विभिन्न राज्यों के अंगूर उत्पादक संगठनों द्वारा आयोजित सेमिनार और प्रक्षेत्र दर्शन द्वारा, केन्द्र में विकसित तकनीकों को उत्पादकों तक पहुँचाया गया। इस केन्द्र के वैज्ञानिकों को विभिन्न संस्थाओं के प्रशिक्षण कार्यक्रमों में स्रोत व्यक्ति के रुप में बुलाया गया। केन्द्र से 'निर्यातक्षम अंगूर उत्पादन' पर एक वीडियो, कई तकनीकी बुलेटिन और पॉप्युलर लेख प्रकाशित हुए हैं।

मानव संसाधन विकास

तीन वैज्ञानिकों और दो प्रशासनिक कर्मचारियों को उनके क्षेत्र में नई जानकारी हासिल करने के लिए देश और विदेश के संस्थानों में भेजा गया।

राजस्व आय

निर्धारित लक्ष्य १२ लाख के मुकाबले, केन्द्र में रु. २१.६४ लाख का राजस्व आय अर्जित किया गया। यह राजस्व आय प्रशिक्षण, सलाह मशविरा, अनुबन्धित अनुसंधान और सेवाएँ, फार्म उत्पाद और पौधा सामग्री बेच कर हुई।

भावी प्रतिबल क्षेत्र

केन्द्र की भावी योजना को परिशेधित किया जा रहा है और मदिरा अंगूरों, जिन की माँग राष्ट्रीय एवं अन्तर्राष्ट्रीय स्तर पर बढ़ रही है, पर अनुसंधान आरम्भ किया जाएगा।

NATIONAL RESEARCH CENTRE FOR GRAPES established in 1997 at Pune has the mandate to undertake the mission oriented programme involving basic and strategic research for resolving the major biotic and abiotic constraints affecting the grape production and productivity and utilization of grapes. To achieve this, research is carried out in the broad areas of crop improvement, crop production, crop protection and post harvest technology.

Though only in 7th year of its existence, the Centre has received recognition from several agencies, which have funded several research projects. The Centre's commitment towards welfare of grape growers and strengthening of the grape industry is acknowledged by the APEDA in identifying this institute as the Nodal agency for monitoring of pesticides residues in export grape from India through National Referral Laboratory and also other programmes to promote the grape export.

Beside 12 institute projects, which are formulated after thorough understanding of the growers need and refined time to time after recommendation of the RAC and SRC, research was carried out under 2 each of NATP, DBT and APEDA projects and several contract research projects. The salient achievements of the Centre are given below:

CROP IMPROVEMENT

The grape germplasm collection at the Centre was enriched with the addition of 25 collections from different parts of the country and 6 accessions from other countries. On the other hand, based on the morphological and ampelometric studies, 22 accessions were found to be the duplicate and hence removed from the germplasm collection. Mutants/budsports of commercial varieties, collected during previous years were extensively evaluated for assessing their commercial value. Some male sterile lines were identified for their use in breeding programme.

The grape germplasm information system, an electronic database of grape germplasm in India was further developed by adding forms for different functions like data entry, delete data etc.
Research to identify the molecular markers linked to downy mildew resistance was intensified. To generate segregating population, Thompson Seedless and Flame Seedless as susceptible parents and Sevye Villard and Seibel as resistant parents were used for crossing. Presently 74 F1 progenies are available. Based on the literature and experience in the field, several resistant and susceptible accessions were identified and included in the study. DNA from these accessions was extracted. Protocols for AFLP and SSR analysis were standardized. Based on the analysis of bulk DNA from resistant and susceptible accessions, AFLP primers giving unique bands were identified. The selected susceptible and resistant parents were screened *in vitro* using leaf disc method, against the pathogen and were categorized on a scale of 1-9 based on UPOV rating.

CROP PRODUCTION

Evaluation of growth performance of Tas-A-Ganesh on different rootstocks showed better performance of this variety on 110R. In this varriety, retention of only 35 shoots after back pruning and maintaining 40 bunches per vine

after forward pruning was found to be optimum for obtaining significantly higher yield, berry weight and berry diameter.

Thompson Seedless grafted on Dogridge-B, gave better quality produce. In Sharad Seedless, girdling at 60 or 75 days after pruning resulted in higher berry weight and diameter and yield. In this variety, retention of 40 bunches per vine was found to be optimum for obtaining higher yield and better quality grapes.

Under flat roof gable system of training, grafted vines yielded significantly higher number of bunches and yield per vine. However, training modifications did not affect yield parameters.

Application of CPPU on bunch with more than 10 leaves resulted in better quality grapes. Efficacy of gibberellic acid could be improved by using the adjuvants like phosphoric acid and urea phosphate in acidic range of pH 3.0 - 6.0.

The quality of Sharad Seedless in terms of berry size, weight and diameter could be improved by the application of GA_3 @ 40 and 30 ppm along with 10 ppm 6-BA at 3-4 mm and 6-7 mm berry size stage, respectively.

The experiment on fertigation confirmed earlier findings that growth stage dependent application of nutrient through drip results in 60 per cent savings on fertilizer requirement. Studies on improving water use efficiency demonstrated the usefulness of rootstocks for higher productivity under saline and scarce water conditions. Vines grafted on rootstocks gave higher yield and brix yield at both 75 per cent and 50 per cent of recommended irrigation dose. Similarly, use of mulch along with Antistress at 75 per cent of recommended irrigation level resulted in yield on par with the recommended levels, suggesting a saving of 25 per cent of irrigation water. In another experiment, use of subsurface irrigation method resulted in up to 25 per cent saving of irrigation water.

CROP PROTECTION

Based on the disease forecasting model, only 4 sprays were used for the management of powdery mildew as compared to 8 sprays under schedule-based management, resulting in the saving of 4 sprays during the fruiting season. Use of potassium bicarbonate (PBC) at a concentration of 0.5 per cent in combination with 0.05 per cent hexaconazole was found to be suitable for better management of powdery mildew. Chitosan alone or in combination with biocontrol agents like *Trichoderma* and *Verticillium* or in combination with KH_2PO_4 showed potential to reduce powdery mildew in grape. In preliminary experiments, unconventional methods like use of Gomutra and milk, KH_2PO_4, azadirachtin formulations were found to be effective in controlling powdery mildew.

Survey on seasonal incidence of important insect pests of grape in different grape growing regions revealed that during November to February, population of thrips, jassids and mealy bug was observed to be above the economic threshold level (ETL). Attempts were also made to relate seasonal incidence of insect pests with the prevailing weather conditions.

Survey was also conducted to document the indigenous methods followed for the control of insect pests by grape farmers. Indigenous methods included the use of different cultural, mechanical, physical, biological and chemical approaches for insect pest management.

The Centre's germplasm was also screened for the response of various varieties and accessions to different pests and varieties / accessions showing varying levels of tolerance and susceptibility were identified.

SHELF LIFE

Preharvest treatment with chitosan @ 1.0 g/L on 20 and 7 days before harvest and packing the grapes with 3.5 g sodium metabisulphite enhanced the shelf life of cold stored grapes by 4 days as compared to the 3.5 g sodium metabisulphite control.

TRANSFER OF TECHNOLOGY

Transfer of technology and information through training programmes, field visits, seminars, and interaction with the grower is an important and integral activity of the Centre. Training programmes on integrated pest management and advances in tropical viticulture received enormous response from the growers. Technologies developed during last few years were transferred to the growers through frequent field visits and seminars organised by the grape growers associations of different states. The scientists of the Centre were frequently invited as resource persons for training programmes organised by other agencies. The Centre produced a video on 'Grapes for Export' besides publication of several technical bulletins and popular articles in local language.

HUMAN RESOURCE DEVELOPMENT

Three scientists and two administrative staff were trained in their respective areas of work by deputing them to professional institutes in the country.

REVENUE GENERATION

Revenue of Rs.21.64 lakhs was generated against the target of Rs. 12.00 lakhs through training, consultancy, contract research and services and sale of planting material and farm produce and interest on term deposit receipts.

FUTURE THRUST

The Perspective Plan of the Centre is being revised to undertake the research programmes on wine grapes, which is receiving more importance.

BRIEF HISTORY

The National Research Centre for Grapes notionally started functioning in Pune at Manjri, from 18th January 1997 but full-fledged activities could begin only when 46.78 ha of land was acquired on 29th January 1998. The Centre started functioning from its Laboratory-cum-Administrative building only from May 2001. A total area of about 32 acre has been planted with Dogridge rootstock, of which 6 acre has been grafted with Thompson seedless and Tas-A-Ganesh cultivars for various experimental trials and 383 indigenous and exotic spp./ varieties / hybrids etc. are also planted to establish the germplasm repository. Extended 'Y' trellises for training the vines to flat roof gable and drip irrigation / fertigation facilities have been established. Two acre of vineyard is grafted with newly introduced commercially important varieties to develop mother block for supplying high quality planting material to the growers. Irrigation facilities have been augmented time to time to meet the water requirement for additional vineyards. Boundary wall cum fencing for the farm area has been completed and the farm roads were laid. A polyhouse for raising *in-vitro* plantlets is constructed with financial assistance from Department of Biotechnology, New Delhi.

All posts except 2 scientific posts and 1 Research Management Personnel post have been filled. Till date there are 13 scientists in position. The Biotechnology, Soil Science, Pesticide Residue, Plant Pathology and Plant Physiology laboratories have been equipped with several sophisticated and basic facilities for research. Research was carried out under twelve institute research projects, two NATP, 2 DBT funded and two APEDA sponsored projects. Research Advisory Committee, Staff Research Council and Institute Management Committee meetings were conducted regularly and their suggestions / recommendations taken for the formulation and prioritisation of research programmes and infrastructure development of the Centre.

Scientific, technical and administrative staff were trained in their specialized fields during this period. Apart from the Centre's vineyards, need based research was also carried out in the R & D farm of Maharashtra State Grape Growers' Association at Manjri and in growers' vineyards. Training, consultancy, contract research, contract services and multiplication of rootstocks were the ongoing revenue generation activities.

UP-TO-DATE ACHIEVEMENTS

The Centre has established and developed a field gene bank of grape germplasm comprising of approximately 387 accessions collected from different sources in India and abroad. The germplasm contains commercial varieties for table, raisin, juice and wine purpose, clonal selections, rootstock varieties and several wild species. Evaluation of this germplasm has resulted in the identification of several useful accessions. A17-3, a clonal selection from Centennial Seedless has been identified for table purpose. Country Bangalore and E 12/2 have been identified as suitable for juice production and Cabernet Sauvignon and Merlot for red wine production.

The compatibility of Dogridge rootstock for Thompson Seedless was established. No significant effect of inverted bottleneck on growth or yield

parameters was recorded in the studies carried out for the last 3 years. This rootstock is being popularised among farmers in areas of water and salinity stress.

An irrigation schedule based on pan evaporation has been developed for optional water use in grapes. The schedule improves the water use efficiency by almost 141 per cent. The importance of fertigation was also demonstrated in vineyards under the Indian conditions. Fertilizer application at the various growth stages through drip resulted in 60 per cent savings in fertilizer use over the conventional method of soil application. The cause of bunch stem necrosis and inward leaf curl was found due to the nutrient deficiency and could be corrected by appropriate nutrient dose application.

Hydrogen cyanamide treatment to induce early and uniform budbreak in grafted Thompson Seedless vines was standardised. Continuous use of hydrogen cyanamide for the last 3 years did not have any deleterious effect on vine growth, productivity or quality of fruits. The treatments also did not result in any residues in grapes at harvest.

Pre-harvest sprays with Benomyl @ 0.05 per cent at 20 + 10 days before harvest or with *Trichoderma harzianum* isolate 5 R, at 20 + 3 days before harvest and packing grapes with lower doses of sodium meta bisulphite (2.3 g per 5 kg grape) for effective prevention of post-harvest decay as well as minimizing the sulphur dioxide injury.

The safe waiting period for benomyl, chlorpyriphos, hexaconazole, mancozeb, iprodione and methomyl was determined for recommending to the grape growers for the safe use of chemicals. Washing grapes with 1 per cent or 2 per cent NaCl or 0.05 per cent $NaHCO_3$ was effective in dislodging the residues of carbendazim and hexaconazole from berry surface.

A disease forecasting software, Metwin 2 from Austria was tested for forecasting of diseases under Indian conditions and it was found useful in the forecasting of downy mildew and anthracnose disease. Forecasting based disease management resulted in saving of as much as 11 sprays during one year of production cycle as compared to the conventional pre-determined schedule based management.

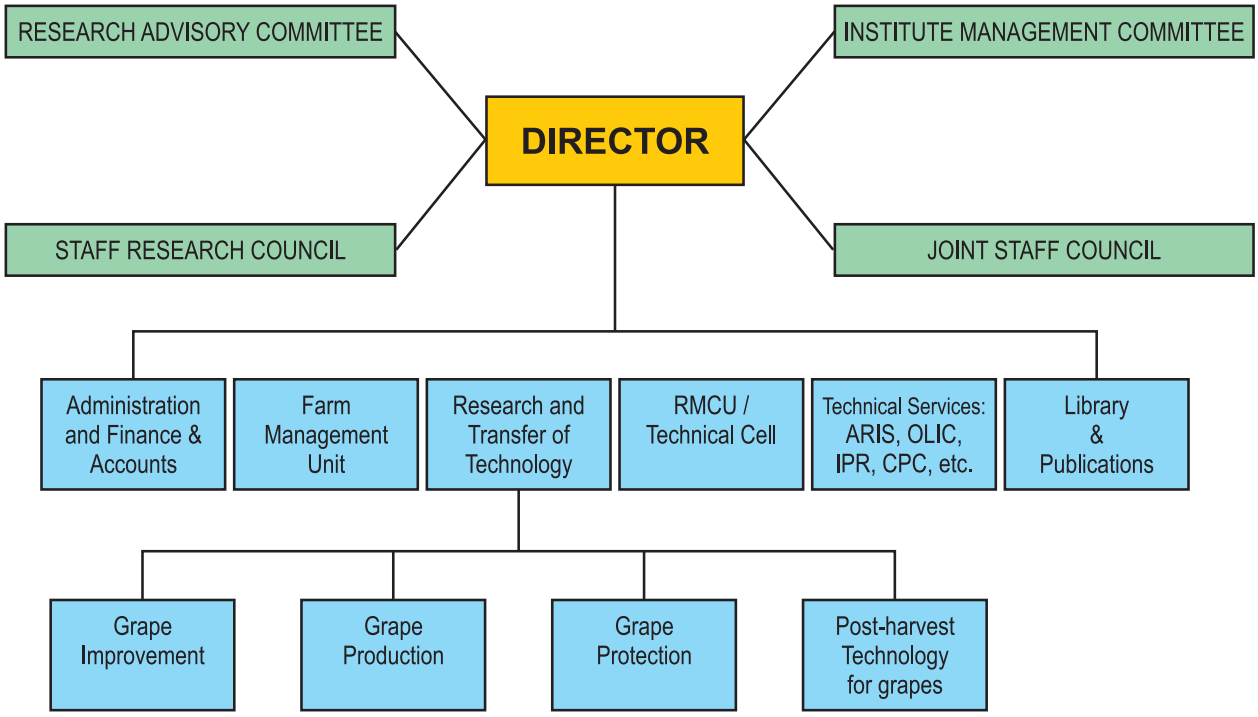
Pest risk analysis demonstrated absence of fruit fly and *Botrytis cinerea* in Indian grapes. Based on the survey carried out for 3 years, it was found that *Botrytis cinerea*, causing serious pre- and postharvest decay of grapes in other countries, is not found in India. The Centre has appraised Ministry of Agriculture to use this information in non-tariff measures in the import of fresh grapes and processed products. Surveys on pest risk analysis also revealed that the Indian vineyards are free from fruit fly infestation, including vineyards in the vicinity of mango and guava orchards. This information will be useful in the export of grapes.

Single pre-harvest treatment with calcium chloride or nitrate @ 1 per cent aqueous solution during 75 to 105 days after pruning, harvesting the berries at green stage and with 20°B, cutting the bunch above the knot, pre-cooling the produce within four hours of harvest, use of high-density polyethylene polyliner and absorbent tissue paper for packing prolonged the shelf life of Thompson Seedless grapes after cold storage.

MANDATE

To undertake mission oriented programme involving basic and strategic research for resolving the major biotic and abiotic constraints affecting the grapes production and productivity and utilization of grapes.

ORGANISATIONAL SETUP



FINANCIAL STATEMENT

(Rs. in Lakhs)

Sl. no.	Heads	R.E. 2003-2004		Expenditure 2003-2004		Final Grant		Revenue Generated
		Plan	Non-Plan	Plan	Non-Plan	Plan	Non-Plan	
1.	Estt. Charges	3.83	51.30	3.83	51.30	3.83	51.30	
2.	O.T.A.	0.00	0.05	0.00	0.05	0.00	0.05	
3.	T. A.	3.00	0.70	3.00	0.70	3.00	0.70	
4.	Other charges	121.10	28.00	121.09	28.00	121.10	28.00	
5.	Works	17.07	20.00	17.07	2.00	17.07	2.00	
	Total	**145.00**	**82.05**	**144.99**	**82.05**	**145.00**	**82.05**	**21.64***

* Revenue of Rs.21.64 lakhs was generated against the target of Rs. 12.00 lakhs through training, consultancy, contract research and services and sale of planting material and farm produce and interest on term deposit receipts.

Audit

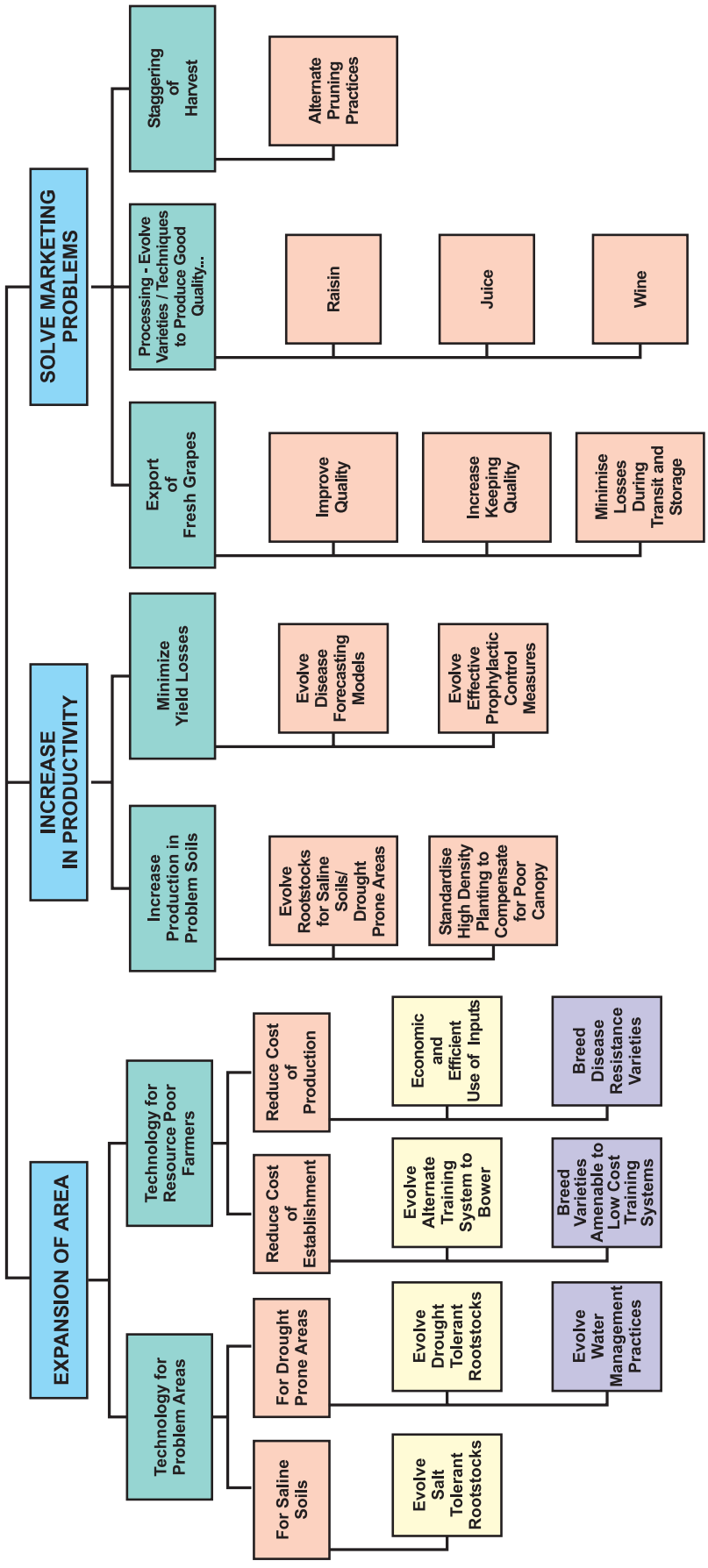
The first external audit of the Centre was held during 12-26th June 2003

STAFF POSITION

Sl.	Post	Number of posts		
		Sanctioned	Filled	Vacant
1.	Research & Management Personnel	1	¾	1
2.	Scientific	15	13	2
3.	Technical	8	8	0
4.	Administrative	8	8	0
5.	Supportive	5 + 2*	7	0
	Total	**37 + 2***	**36**	**3**

* Transferred along with posts from ICAR Research Complex, Patna.

THRUST AREAS OF RESEARCH



Genetic Resource Management and Crop Improvement

A. Germplasm collection and introduction
(G.S. Karibasappa and P.G. Adsule)

During the year, 25 new accessions were collected from different sources in the country and 6 exotic accessions (Table 1) were introduced. Based on the morphological and ampelometric characters, 22 accessions were found to be duplicates/redundants with the existing ones and thus removed from the list. At present, germplasm has the cumulative collection of 383 accessions.

Table 1. Introduction of Exotic Varieties

Sl. No.	Name of the exotic variety & EC Number	Source	Remarks
1.	Frumaosa Alba (EC 537888)	Institute Vinograda, Ukraine	Guzalkara x Seyve Villard 20473
2.	Moldova (EC 537889)	- do -	Guzalkara x Seyve Villard 12375
3.	Muscat (EC 538105)	IPALAC, ICRISAT, Sahelian Centre, Niger	White table grape
4.	Red Globe (EC 538106)	- do -	Red table variety
5.	Red Gala (EC 538107)	- do -	Red table variety
6.	Aurelius (EC 538842)	Czechoslovakia	White table grape

B. Evaluation of natural mutants
(G.S. Karibasappa and P.G. Adsule)

Five natural mutants were compared with their respective parents for morphological and horticultural traits. Mutants of Tas-A-Ganesh and Thompson Seedless have been selected for their bold berries with single application of GA_3 at fruit set or 3-4 mm stage, whereas mutants of Sonaka for its novel leaf characteristic and KRW mutant for its greenish berries instead of original red colour. These mutant clones have been successfully grafted *in situ* on DogRidge rootstock for further studies.

C. Evaluation of grape varieties for early maturity and ripening period
(G.S. Karibasappa)

Nine grape varieties *viz*. Thompson Seedless, Thompson Seedless (Italy), A17-3, Centennial Seedless, Arka Shweta, Mint Seedless, Sultanie-II, Arka Chitra and Superior Seedless were evaluated for early maturity and ripening. Related parameters such as berry weight, berry volume, berry diameter and TSS were measured at different stages during and after veraison. Observations were recorded at 75 days (stage-1), 90 days (stage-2), 105 days (stage –3) and 120 days (stage – 4) after pruning.

Berry weight differed significantly among the varieties. All genotypes except A17-3 recorded slow increase in berry weight till 105 days (Fig. 1). A17-3 showed sharp rise up to 120 DAP. Superior seedless had much higher berry weight compared to other varieties at all the stages during and after veraison. Thompson seedless, Sultanine-II and Arka Shweta recorded slow increase in berry weight. Similar pattern was recorded for change in berry volume (Fig. 2).

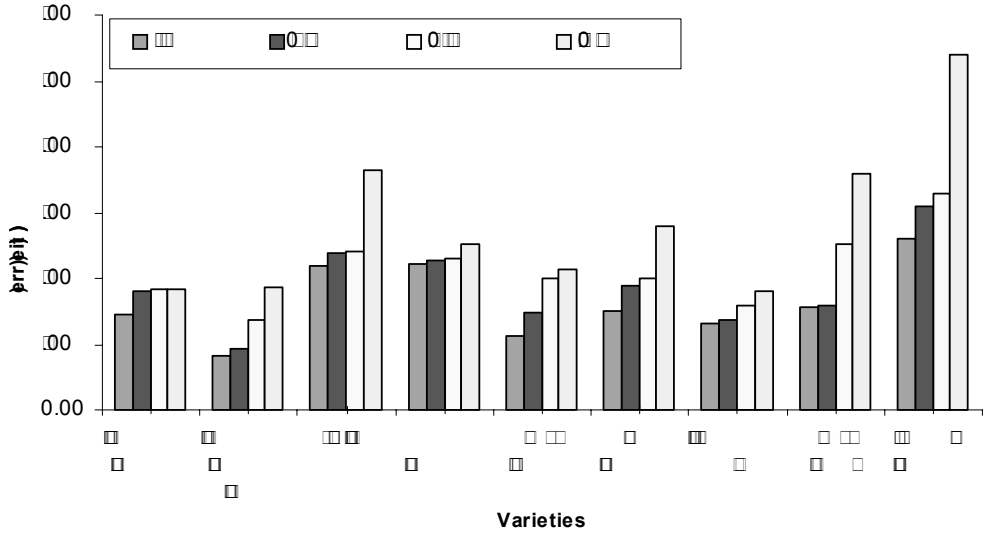


Fig. 1. Increase in berry fresh weight during veraison to ripening in grape varieties

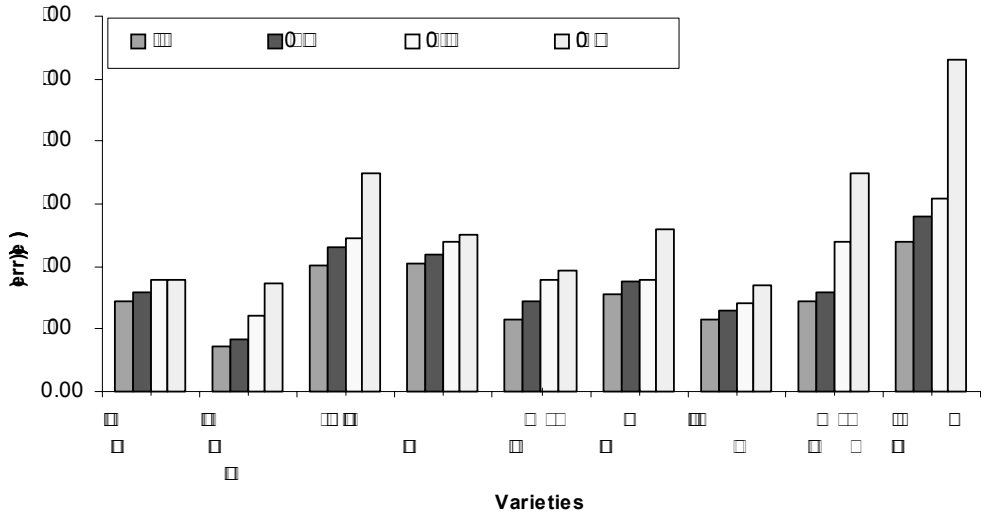


Fig. 2. Increase in berry volume during veraison to ripening

All the varieties recorded sharp increase in berry diameter after 105 days after pruning (Fig. 3).

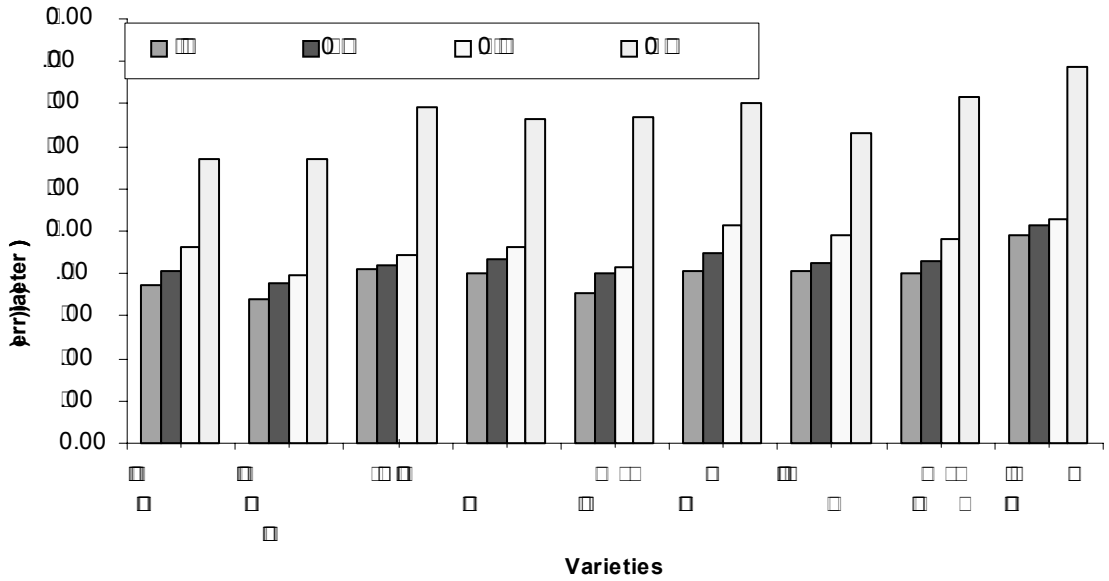


Fig. 3. Growth of berry diameter during veraison to ripening

TSS content increased sharply between 90 and 105 DAP in the seven varieties (Fig. 4). However, in Superior Seedless, TSS was much higher at 75 days indicating the early onset of ripening. Centennial Seedless, Thompson Seedless and Thompson Seedless (Italy) recorded sharp increase in TSS between 90 and 105 DAP. In Arka Chitra, TSS build up was slow and poor and due to late on-set of ripening this variety showed lower TSS level even after 120 DAP. Higher TSS (> 20° brix) was recorded in Centennial Seedless and two Thompson Seedless varieties at the end of 120 DAP.

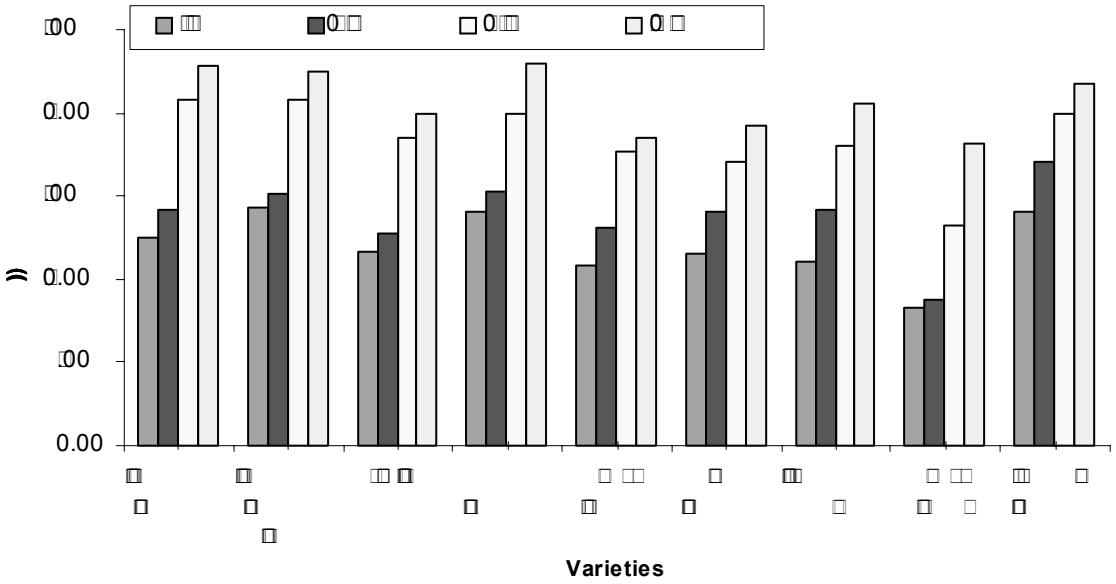


Fig. 4. Increase in berry TSS during veraison to ripening

The level of titrable acidity on the other hand decreased steadily between 75 and 105 DAP in Superior and Thompson Seedless from Italy and

increased in Arka Shweta. Acidity declined sharply after 90 DAP in all the 9 varieties and reached towards equilibrium and stable levels between 0.3 to 0.7 per cent at 120 DAP (Fig 5).

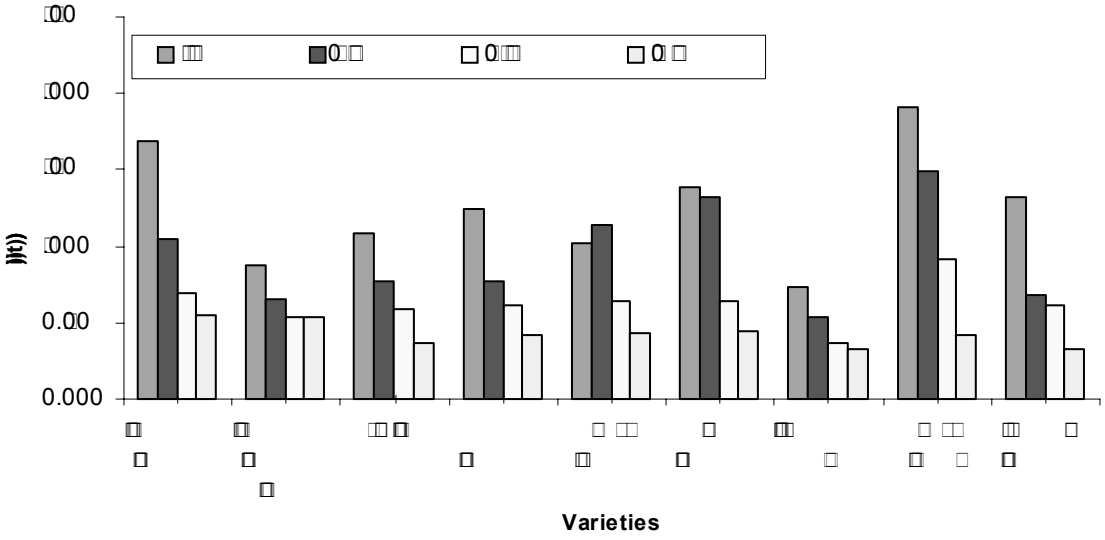


Fig. 5. Level of berry acidity during veraison to ripening

Dry matter accumulation was slow but steady between 75-120 DAP in 5 varieties *viz.* Superior Seedless, Centennial Seedless, two Thompson Seedless varieties and Sultanine-II, whereas rapid accumulation of dry matter in berry was recorded during 90-105 DAP in Arka Chitra, A 17-3, Mint Seedless and Arka Shweta (Fig.6).

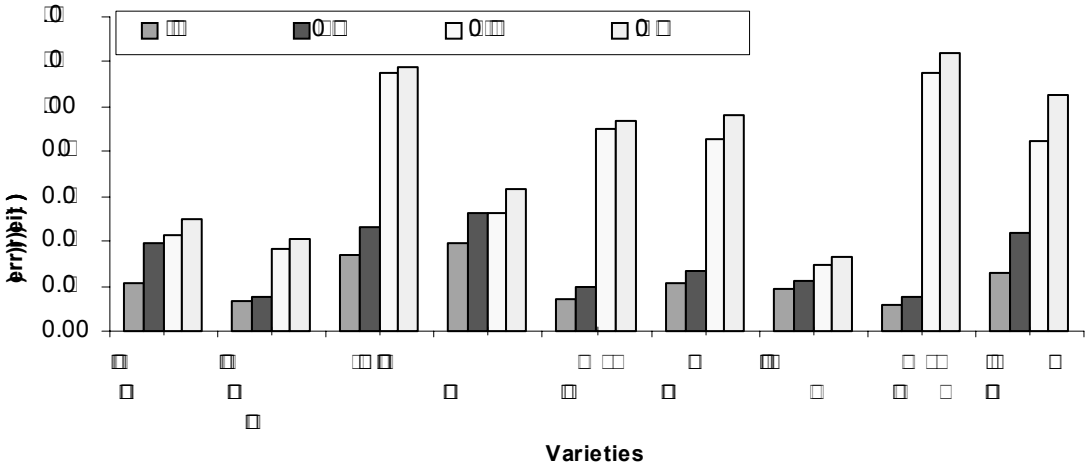


Fig.6 Increase in berry dry weight during veraison to ripening

High TSS : acid ratio along with moderately high level of acidity and high dry matter content of berries is desirable for better keeping quality. This study helped in understanding of these quality parameters during different stages of maturity in different grape varieties.

D. Prebreeding and Genetic Enhancement *(G.S. Karibasappa)*

i. Evaluation of male sterile lines

The male sterility in five genotypes *viz*. Arka Trishna, Madelein Angevine, Spin Sahebi, Katta Kurgan and *Vitis parviflora* was noticed initially by the presence of reflex stamens. However, to further study this character, 20 bunches were bagged for selfing at pre-flowering stage in each genotype. Observations recorded between fruit set and veraison indicate bunch set in Arka Trishna (40%), Spin Sahebi(30%) and Katta Kurgan (50%) with few berries (Table 2). These berries developed with undersized / shrivelled seeds in Arka Trishna, Katta Kurgan and Spin Sahebi and none of the seeds germinated. There was no berry set in selfed Madelien Angevine and *Vitis parviflora.*

Table 2. Evaluation for self-male sterility in grape varieties

Sl. No.	Variety	Bunches set (%)	No. of berries	No. of seed set / bunch	Weight of seed(g)/ bunch
1.	Arka Trishna	40.0	7.8±12.1	6.45±11.7	0.04±0.08
2.	Madelein Angevine	0.0	0.0	0.0	0.0
3.	Spin Sahebi	30.0	5.0±9.48	18.4±44.4	0.493±1.22
4.	Katta Kurgan	50.0	1.4±1.55	0.0	0.0
5.	*Vitis parviflora*	0.0	0.0	0.0	0.0

E. Grape germplasm information system *(Kavita Mundankar)*

The objective of this project is to develop a database for grape germplasm in India. During the period of report, forms have been coded to allow the user to add the accession information in the database, to delete the accession information, to save the changes made in the accession information and to display information about the desired accession from the database by selecting accession number or name. Testing and evaluation of this information system is underway.

F. Molecular tagging of downy mildew resistance *(Anuradha Upadhyay, G.S. Karibasappa* and *Indu S. Sawant)*

i. Selection of plant material and DNA extraction

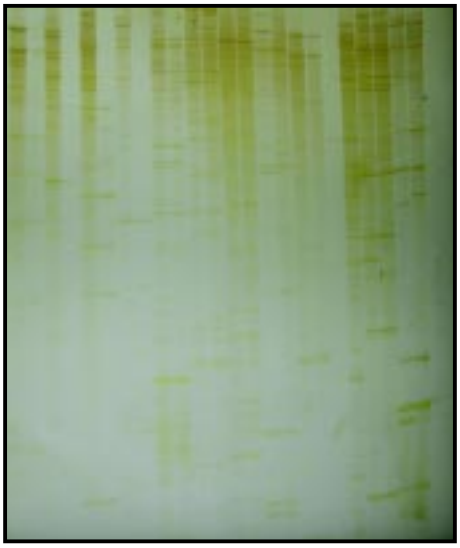
AFLP and SSRs markers are being used for identification of markers linked to downy mildew resistance. For initial screening of the primers, several susceptible and resistant varieties are selected. The susceptible accessions are Thompson Seedless, Flame Seedless, Gulabi, Kali Sahebi, Bharat Ruba Black, E 8/5, E2/1, Anab-e-Shahi, Alamwick, Delight. Resistant accessions are Seibel (2 lines), CBR, *Vitis parviflora*, H533, *Vitis longii*, Sevye Villard (6 lines), Concord, Catawba, Lake Emerald, Fruhroter Veltliner, St. George and Kanai local (*Vitis lanata*). Using standardized protocol, DNA has been extracted from 3 vines each of selected susceptible and resistant material. The DNA has been purified, quantified and tested on the agarose gel for its quality.

ii. Generation of segregating population

Two susceptible varieties *viz.* Thompson Seedless (TS) and Flame Seedless (FS) are selected as female parents whereas Seibel and Sevye Villard (SV), two well-established source of downy mildew resistance are selected as male parent. Thompson seedless and Flame Seedless were crossed with Sevye Villard. At present, 51 progenies from TS x SV and 23 progenies from FS x SV are available and are maintained in poly house.

iii. Standardization of PCR parameters

Varying concentrations of different PCR parameters *viz.* DNA (25 and 40 ng), dNTP (100 and 150 mM), primer (5,10,15,20,25,35, and 45 pg), $MgCl_2$ (2, 3 and 4 mM) and annealing temperature (35-55°C) were used to find the optimum level of each one. Primer OPA 4 was used for this experiment. The amplified product was resolved on 1.2% agarose gel and visualized by ethidium bromide staining. 25 ng of DNA, 100 mM each dNTP, 15 pg primer, 3 mM $MgCl_2$ and annealing temperature of 50°C were found to be the optimum and resulted in consistent and reproducible PCR amplification.



AFLP analysis of bulked DNA of resistant & susceptible varieties

iv. Screening of AFLP primers

In preliminary screening, sixty four primer combinations from commercially available AFLP kit were used to amplify DNA from two grape varieties *viz*. Thompson Seedless, a commercial variety susceptible to downy mildew and Lake Emerald, one of the resistance donor. The amplified products were resolved on 6% denaturing polyacrylamide gel and visualized by silver staining. Out of 64, 61 primer combinations amplified grape DNA, however, only 53 primer combinations detected polymorphism between these two parents.

To further identify the most promising primers, polymorphic primers were used to amplify bulk DNA of resistant and susceptible vines. Twenty eight

primers gave unique bands either for resistant or susceptible bulk DNA. These primers will be used to analyse individual vines.

v. Standardisation of SSR parameters

SSR primers specific for grape were commercially synthesised. Two primers were used to standardize the optimum conditions for amplification of specific bands. Different concentrations of DNA, dNTPs, $MgCl_2$, and primer were used. Similarly, different temperature profiles and number of PCR cycles were tried to find the optimum conditions. Reproducible bands in expected molecular weight range and without non-specific bands were obtained with 25 ng DNA, 100 mM dNTP, 3.5 mM $MgCl_2$, 1.332 mM primer and 45 cycles of two step touch down PCR.

vi. Screening of selected accessions against *Plasmopara viticola*

Downy mildew pathogen, *Plasmopara viticola* is an obligate parasite. The selected susceptible and resistant parents were screened *in vitro* using leaf disc method against the pathogen and were categorized on a scale of 1-9, with 1 being the highly resistant and 9 being the highly susceptible.

In vitro screening

Accessions, which did not produce any sporangiophore, are rated as resistant. Natural inoculum from field gave better results than inoculum harvested from detached leaves incubated in the laboratory. Rotting of leaf disc of the susceptible varieties during incubation was observed which could be minimized by the use of benomyl. The susceptible varieties *viz*. Thompson Seedless and Flame Seedless had a score of 5-7, whereas score for resistant varieties Sevye Villard, Catawba, Concord and lake Emerald was less than 1.5 (Table 3).

Table 3. Disease rating of some of the varieties based on leaf disc method

Sl. No.	Variety	Rating Score
1.	Catawba	1.44
2.	Concord	1.34
3.	Lake Emerald	1.21
4.	Fruhroter Veltliner	3.07
5.	Seyve Villard	1.25
6.	St. George	2.83
7.	Flame Seedless	6.42
8.	Thompson Seedless	4.63

A. Performance of Tas-A-Ganesh on different rootstocks

(R. G. Somkuwar, J. Sharma, A.K. Upadhyay and S. D. Ramteke)

With the problems of salinity and drought in different grape growing regions, own rooted grapes are being replaced with vines grafted on rootstock. An experiment was therefore conducted to study the performance of three-year-old Tas-A-Ganesh on two different Dogridge (Dogridge A and Dogridge B), 110 R and in comparison to that of own rooted vines. The data has been presented in table 4.

Table 4. Performance of Tas-a-Ganesh on different rootstocks

Rootstocks	Number of bunches/ vine	Shoot Length (cm)	Berry Length (cm)	TSS (° Brix)	Acidity (%)	Yield / Vine (kg)
Own root	36.80	66.69	18.46	19.52	0.77	2.397
Dogridge A	78.50	81.11	16.28	17.64	0.80	5.628
Dogridge	65.60	91.90	18.66	19.88	0.68	5.426
110 R	82.80	116.43	16.84	17.72	0.83	6.049
SEM ±	5.715	6.087	0.436	0.419	0.032	0.535
CD at 5%	17.60	18.75	1.34	1.29	0.09	1.65

The data revealed that number of bunches/vine and shoot length was maximum on 110 R followed by Dogridge A and Dogridge respectively whereas number of canes/vine were maximum in Dogridge A rootstock.The vines grafted on all three rootstocks produced significantly higher yield than own rooted vines. Though highest yield was recorded in case of 110 R rootstock, it was statistically at par with other two rootstocks used in the study. There was no significant difference among the different stock:scion combination with respect to average bunch weight, cane diameter and internodal length.

B. Quality and shelf life of Thompson Seedless grafted on different rootstocks

(R. G. Somkuwar and S. D. Ramteke)

With the increasing problems of salinity and drought in grape growing regions, grapes are being grown on different rootstocks. The harvested grapes are sent to the international market for export. The exported grapes should have longer shelf life till it reaches the consumers. In this context, an experiment was conducted to compare the shelf life of Thompson Seedless grapes grafted on different rootstocks (Dogridge, Salt Creek, 1613 C and St. George). Five kg grapes from each rootstock were harvested and kept in cold storage for 30 days. After removal from the

cold storage these grapes were kept for 5 days under ambient temperature to study their shelf life and quality at 5th day in shelf.

The data recorded on four-year-old Thompson Seedless grapes grafted on four different rootstocks for bunch quality are presented in table 5. Average bunch weight and berry length was significantly higher in Dogridge. Highest berry diameter was recorded in vines grafted on Dogridge followed by Salt Creek, 1613 C and St. George. The differences for number of bunches per vine, TSS and acidity were non significant.

Further, percent physiological loss in weight (PLW) of grapes harvested from vines grafted on Dogridge rootstock was significantly less than vines grafted on other rootstocks. Similarly,bunches harvested from vines grafted on Dogridge recorded significantly lower percent fallen and rotten berries compared to those from other rootstocks. Amongst the vines grafted on different rootstocks, highest pedicel thickness was recorded in vines grafted on Dgridge which was on par with Saltcreek but significantly higher than the two rootstocks. Increase in shelf life was probably due to the thick pedicel in Dogridge rootstock as compared to other rootstocks studied. Thick pedicel can have more reserves of food material, which are supplied to the berries under storage to extend shelf life. However, further studies are required on other quality and shelf life parameters.

C. Standardization of training system and method for own rooted and grafted Tas-A-Ganesh *(R.G. Somkuwar)*

Canopy management plays an important role in yield and quality of table grapes. Due to the difficulties in bower associated training system, flat roof gable is gaining importance. An experiment was conducted to study the performance of own rooted and grafted Tas-A-Ganesh on flat roof gable system of training. The treatment details are as follows:

T1 - Single cordon horizontal

T2 - Single cordon diagonal

T3 - Double cordon horizontal

T4 - Double cordon diagonal

T5 - Four cordon horizontal

T6 - Four cordon diagonal

Double cordon horizontal

The data presented in table 6 revealed that number of canes were significantly higher in grafted vines as compared to own rooted vines. Significant differences in cane number were also recorded under different modifications. Under own rooted vines maximum number of canes were recorded in T6 and T5 treatments followed by T3, T4, T2 and T1 respectively. The same trend was also observed under grafted vines for number of canes/vine. Number of bunches/ vine were significantly higher among the different modifications in own root however, the differences were non significant under grafted vines. Maximum bunch weight was

Table 5. Shelf life studies in relation to Thompson Seedless on different rootstocks

Rootstocks	Number of bunches/ vine	Average bunch weight (g)	Berry diameter (mm)	Berry length (cm)	TSS (° Brix)	Acidity (%)	PLW (%) at 5th day	Fallen berries (%) at 5th day	Rotten berries (%) at 5th day	Pedicel thickness (mm)
Dogridge	58.40	232.94	16.18	20.20	21.32	0.50	12.12	5.5	1.33	1.69
Salt Creek	65.20	209.84	15.72	19.08	21.40	0.47	13.10	6.62	1.53	1.63
1613 C	52.80	229.78	15.68	19.20	20.96	0.50	13.07	7.53	2.78	1.49
St. George	69.60	206.88	15.58	19.04	21.14	0.50	14.02	8.39	3.21	1.48
SEM ±	4.723	2.269	0.074	0.166	0.364	0.011	0.137	0.131	0.149	0.017
CD at 5%	NS	6.993	0.231	0.512	NS	NS	0.423	0.404	0.461	0.054

Double cordon diagonal

recorded under grafted vines as compared to the own rooted vines, however, the differences for different modifications were non significant under grafted vines. The same trend was also observed for berry weight. Yield/vine was significantly higher in grafted vines compared to own rooted vines whereas treatments did not affect the yield significantly.

D. Effect of single and double stem on growth and yield parameters of Tas-A-Ganesh grafted on Dogridge in FRG (*R. G. Somkuwar* and *S.D.Ramteke*)

Nutrient storage after April pruning plays an important role in achieving high yield. The food is stored in cane, cordon and stem or trunk. Generally grapes are cultivated by maintaining single stem. However, retention of two stems on grafted vines is gaining popularity in some areas. An experiment was therefore conducted to study the effect of double stem on growth and yield of Tas-A-Ganesh grafted on Dogridge rootstock.

The treatment details are as follows:

Single Stem	Double Stem
Single cordon horizontal	Single cordon horizontal
Single cordon diagonal	Single cordon diagonal
Double cordon horizontal	Double cordon horizontal
Double cordon diagonal	Double cordon diagonal
Four cordon horizontal	Four cordon horizontal
Four cordon diagonal	Four cordon diagonal

The data recorded on various growth and yield characters are presented in table 7. The data revealed that maximum biomass at October pruning was recorded in double stem followed by single stem. Under double stem it was more in single cordon horizontal, however, under single stem more biomass was recorded in double cordon diagonal. The differences were significant for training methods only. Maximum shoot length was recorded in single cordon horizontal under double stem. Higher number of canes/vine was recorded in double stem than the single stem. It was more in four cordons horizontal under double stem whereas under single stem maximum canes were recorded in four-cordon diagonal. Significant differences were recorded for number of bunches/vine. Maximum bunches were found in double stem than in single stem. However, the interaction effect was non significant. Yield was significantly higher in double stem compared to single stem. The different training methods did not affect the yield significantly.

Double stem

Table 6. Performance of Tas-A-Ganesh under flat roof gable training system

Treatment	Total Number of Canes / Vine			Number of Brunches / Vine			Bunch Weight (gm)			Berry Weight (gm)			Berry Diameter (mm)			Yield / Vine (kg)		
➧ Cordon A Rootstocks (B) ➧	Own Root	Grafted	Mean B	Own Root	Grafted	Mean B	Own Root	Grafted	Mean B	Own Root	Grafted	Mean B	Own Root	Grafted	Mean B	Own Root	Grafted	Mean B
T1	30.7	28.4	29.55	33	45.15	39.07	124.22	160.39	142.30	2.83	3.10	2.97	11.41	16.16	13.78	4.15	7.28	5.72
T2	33.5	38.85	36.17	40	46.45	43.22	111.23	160.65	135.94	2.64	3.11	2.88	15.54	16.19	15.87	4.44	7.45	5.94
T3	41.4	40.3	40.85	39.65	50.5	45.07	113.36	154.83	134.09	2.67	3.14	2.90	15.54	16.1	15.82	4.48	7.84	6.16
T4	38.05	41.25	39.65	37.9	56.30	47.1	110.4	150.12	130.28	2.62	2.99	2.80	15.40	16.16	15.78	4.18	8.49	6.33
T5	42.45	49.5	45.97	43.5	54.35	48.92	112.98	131.73	122.26	2.7	2.86	2.78	15.78	15.69	15.74	4.90	7.15	6.03
T6	42.45	55.95	49.2	41	60.05	50.52	120.32	153.79	137.06	2.78	2.95	2.86	16.14	15.84	15.99	4.91	9.27	7.09
Mean A	38.09	42.37	-	39.17	52.13	-	115.42	151.92	-	2.71	3.02	-	14.97	16.02	-	4.51	7.91	-
	A	B	A x B	A	B	A x B	A	B	A x B	A	B	A x B	A	B	A x B	A	B	A x B
SEM ±	1.00	1.73	2.44	1.52	2.64	3.73	2.18	3.77	5.34	4.06	7.03	9.95	0.47	0.81	1.15	0.25	0.44	0.63
CD at 5%	2.87	4.98	7.05	4.39	NS	NS	6.28	NS	NS	0.11	NS	NS	NS	NS	NS	0.745	NS	NS

Table 7. Effect of Single and Double stem canopy on the performance of Tas-A-Ganesh

	October blomass (kg)			Shoot length (cm)			Total Number of canes/ vine			Number of bunches/ vine			Yield/ vine (kg)		
Treatment	Single Stem	Double Stem	Mean B	Single Stem	Double Stem	Mean B	Single Stem	Double Stem	Mean B	Single Stem	Double Stem	Mean B	Single Stem	Double Stem	Mean B
T1	0.33	0.55	0.44	71.20	70.68	70.94	28.4	33.55	30.97	45.15	44.08	44.61	7.28	7.12	7.20
T2	0.38	0.53	0.46	61.06	73.11	67.09	38.85	41.9	40.37	46.45	56.15	51.30	7.45	9.52	8.48
T3	0.39	0.52	0.45	55.17	59.14	57.15	40.3	48.95	44.62	50.5	53.15	51.82	7.84	8.61	8.22
T4	0.42	0.43	0.43	60.38	60.71	60.55	41.25	42.7	41.97	56.30	62.7	59.5	8.49	9.30	8.89
T5	0.26	0.32	0.29	55.25	53.07	54.16	49.5	64.5	57	54.35	75.10	64.72	7.15	12.06	9.60
T6	0.30	0.31	0.30	55.60	56.05	55.82	55.95	49.7	52.82	60.05	65.85	62.95	9.27	10.04	9.66
Mean A	0.35	0.44	-	59.78	62.12	-	42.37	46.88	-	52.13	59.50	-	7.91	9.44	-
	A	B	A x B	A	B	A x B	A	B	A x B	A	B	A x B	A	B	A x B
SEM ±	0.019	0.034	0.048	1.37	252.37	3.36	1.22	2.12	2.99	1.67	2.90	4.11	0.34	0.59	0.84
CD at 5%	0.06	0.09	NS	NS	6.84	NS	3.52	6.10	8.63	4.83	8.37	NS	0.99	NS	NS

E. Effect of girdling on yield and quality in Sharad Seedless grapes

(*R. G. Somkuwar, J. Sharma* and *S. D. Ramteke*)

The consumers always prefer bunches having bold berries. It can be achieved by different cultural practices. Increase in the berry size for better quality and price in the market was the main objective of the experiment. During the second year of experiment, the girdling was done on the same vine of two year old Sharad Seedless grafted on Dogridge rootstock. The girdling was done as per the treatments. The results have been presented in table 8.

The data revealed that maximum bunch weight was recorded when girdling was done at 75 days after forward pruning followed by 60 days. Maximum berry weight was recorded at girdling after 60 days (Table 8). Berry diameter and TSS were higher at 60th day girdling treatment. Highest yield was obtained in case of trunk girdling at 75 days after pruning, which was statistically at par with trunk girdling at 45 and 60 days after pruning and cane girdling at 75 DAP. All trunk girdling treatments resulted in significantly higher yield than cane girdling. Berry weight was also significantly higher in trunk girdling treatments. All the trunk girdling treatments and cane girdling at 75 days after pruning increased the berry diameter and TSS significantly. These results indicate the beneficial effect of girdling at 60th or 75th days after pruning.

Table 8. Effect of girdling on yield and quality of Sharad Seedless

Treatments	Bunch Weight (g)	Berry Weight (g)	Berry Diameter (mm)	TSS (° Brix)	Acidity (%)	Yield / Vine (kg)
Trunk girdling at 45 DAP*	217.61	3.46	17.20	20.05	0.32	8.704
Trunk girdling at 60 DAP*	238.02	3.90	18.02	21.67	0.41	9.207
Trunk girdling at 75 DAP*	240.19	3.60	17.77	21.12	0.37	9.607
Cane girdling at 75 DAP*	185.59	2.82	16.75	19.45	0.33	7.423
Cane girdling at 90 DAP*	156.83	2.71	16.27	17.65	0.31	6.268
Control	153.22	2.23	15.72	17.51	0.27	6.126
SEM ±	18.829	0.212	0.288	0.392	0.019	0.763
CD at 5%	78.73	0.640	0.869	1.181	0.058	2.301

*** DAP: Days after purning**

F. Effect of bunch retention on quality and yield in Sharad Seedless

(R. G. Somkuwar and S. D. Ramteke)

Bold berry size is a pre-requisite in the market for a buyer. Quality of the grapes depends on berry and bunch size. Number of bunches per vine affect the size of a bunch and berry. Therefore, an experiment was continued for the second consecutive year to study the effect of bunch retention on yield and quality of Sharad Seedless grapes. The bunches per vine were maintained as 30, 35, 40, 50 and above 50.

Highest bunch weight was observed when 40 bunches were retained per vine. The bunch weight reduced significantly when the number of bunches / vine were increased to 50 or more than 50 (Table 9). Reducing the bunch number below 40 per vien did not affect the bunch weight significantly. Maximum berry diameter and TSS as well as yield was obtained when 40 bunches were retained on a vine.

Considering the yield, bunch weight, berry diameter and TSS, retention of 40 bunches/vine was found to be good for yield and quality in Sharad Seedless grapes.

Table 9. Effect of bunch retention on yield and quality in Sharad Seedless

Treatment (Number of bunches/ vine)	Bunch Weight (g)	Berry Weight (g)	Berry Diameter (mm)	TSS (° Brix)	Acidity (%)	Yield / Vine (kg)
30	219.63	21.75	16.37	21.25	0.39	6.588
35	212.58	21.05	17.77	21.05	0.40	7.440
40	227.28	20.85	18.15	22.10	0.44	9.091
50	163.22	20.65	16.12	21.90	0.35	8.145
> 50	149.20	19.82	15.92	21.90	0.36	8.535
SEM ±	6.942	0.321	0.366	0.201	0.016	0.300
CD at 5%	21.390	0.990	1.129	0.619	0.049	0.926

G. Yield and quality in relation to number of canes and bunches per vine in Tas-A-Ganesh grapes

(R. G. Somkuwar and S. D. Ramteke)

After back pruning, approximately 75-80 shoots sprouts on each vine. Retaining all the shoots causes competition for nutrients by overcrowding, lack of photosynthesis, easy spread of disease and also the reduction in fruitfulness of the vine. Removal of extra shoots is necessary to achieve the target of quality yield for export. An experiment was therefore conducted on two year old Tas-A-Ganesh grafted on Dogridge rootstock

to standardize the number of canes and also bunches per vine spaced at 10 feet × 6 feet distance. Number of canes / vine was maintained after back pruning whereas number of bunches were maintained after forward pruning by this.

Significant differences were observed among all the characters studied. Shoot length, cane diameter and leaf area per bunch were significantly higher in 30 shoots + 40 bunches treatment. Average bunch weight was significantly higher in 35 shoots + 40 bunch treatment as compared to other treatments (Table 10). Maximum berry weight and berry diameter was recorded by retaining 35 shoots + 35 bunches /vine whereas berry length was more in 35 shoots + 40 bunch treatment. TSS was higher in 25 shoots + 25 bunches, but significantly higher yield was recorded in 35 shoots + 40 bunches treatment.

Considering all other parameters, retention of 35 shoots after back pruning and maintaining 40 bunches per vine spaced at 10 feet × 6 feet distance after forward pruning is the ideal.

H. Yield and quality in relation to number of leaves above bunch in Tas-A-Ganesh grapes (*R. G. Somkuwar* and *S. D. Ramteke*)

Food materials in the form of nutrient stored after back pruning in different parts of vine (trunk, cordon, canes, etc.) play an important role for bunch development after forward pruning. Among these, leaves act as source for the growth and development of sink, a bunch. An experiment was conducted to study the presence of leaves above bunch on yield and quality in two-year-old Tas-A-Ganesh grapes grafted on Dogridge rootstock.

The treatment details and observations recorded are given in table 11. Results indicated that shoot length and leaf area/ shoot was significantly higher when more than 12 leaves above bunches were maintained compared to other treatments. Significantly higher berry length was recorded in 6–8 leaves above bunch. Higher TSS was recorded under 8–10 leaves above bunch. The treatments 1–3 leaves above bunch produced minimum acidic berries. Juice pH was maximum under 6–8 and 8–10 leaves above bunch but the yield differences among the treatments were non significant.

The results indicated that instead of number of leaves above bunch after October pruning, total leaf area in canopy determine the bunch quality. Hence, the food reserve of vine appears to be important in determining the quality. However, adequate number of leaves are required to be maintained after bunch to protect from sunburn. Further studies are in progress in this respect.

Table 10. Yield and quality in relation to number of canes and bunches per vine in Tas-A-Ganesh grapes

Treatments	Shoot Length (cm)	Cane Diameter (mm)	Leaf Area/ Bunch (cm^2)	Bunch Weight (g)	Berry Weight (g)	Berry Diameter (mm)	Berry Length (cm)	TSS (° Brix)	Yield (kg/ vine)
35 shoots + 40 bunches	74.46	7.69	1768.51	399.33	3.95	18.00	20.66	17.53	15.767
35 shoots + 35 bunches	87.13	7.93	1594.07	397.67	4.13	18.20	20.13	18.73	13.755
30 shoots + 40 bunches	95.40	9.39	4043.63	370.73	3.54	17.60	19.61	17.60	14.380
30 shoots + 35 bunches	94.37	9.37	1770.19	341.97	3.44	17.30	19.00	16.80	12.883
25 shoots + 40 bunches	91.96	9.38	3243.50	302.99	3.08	16.70	19.36	18.06	12.148
25 shoots + 35 bunches	88.53	8.12	2113.80	333.18	3.30	16.90	18.17	18.13	11.490
25 shoots + 25 bunches	90.10	8.64	2852.26	375.85	3.74	18.10	19.76	20.33	9.509
SEM ±	2.999	0.149	337.78	10.811	0.133	0.314	0.283	0.117	0.292
CD at 5%	9.24	0.45	1040.73	33.31	0.41	0.97	0.87	0.36	0.90

Table 11. Yield and quality in relation to number of leaves above bunch in Tas-A-Ganesh grapes

Treatments	Shoot length (cm)	Leaf area per shoot (cm^2)	Bunch weight (g)	Berry diameter (mm)	Berry length (cm)	TSS (°Brix)	Acidity (%)	Juice pH	Yield (Kg/vine)
No leaf above bunch	18.02	148.50	337.20	17.46	21.40	17.80	0.38	3.61	13.46
1-3 leaves above bunch	22.64	400.82	296.83	16.46	20.00	16.26	0.34	3.55	12.18
3-5 leaves above bunch	46.59	656.75	337.03	17.50	20.83	16.80	0.40	3.57	13.45
6-8 leaves above bunch	49.17	940.21	314.80	17.73	21.83	18.66	0.38	3.73	12.57
8-10 leaves above bunch	76.21	1124.63	330.23	17.33	21.40	19.60	0.39	3.73	13.18
10 - 12 leaves above bunch	99.30	1207.33	333.06	16.53	19.50	16.80	0.35	3.72	13.30
> 12 leaves above bunch	155.48	1724.34	326.10	17.86	17.60	18.60	0.42	3.66	13.02
SEM ±	6.697	156.97	34.73	0.466	0.715	0.382	0.051	0.011	1.379
CD at 5%	20.63	483.65	NS	NS	2.20	1.17	0.15	0.03	NS

I. Developing fertigation schedule for grapes
(J. Sharma and *A. K. Upadhyay)*

This experiment was started in the year 2000 to improve fertilizer use efficiency and develop a fertigation schedule in grapes. Three fertigation doses applied under three different schemes were compared with recommended soil application of NPK. Of the three different schemes in the earlier experiments, the scheme I was found better and was continued. The other two schemes were discontinued. The treatment details are given in table 12.

The data on yield, yield attributes and nutrient content are presented in tables 13 and 14. All the fertigation treatments were statistically at par with conventional treatment (T4) both in terms of yield as well as brix yield. Treatment 60% NPK applied through drip (T2) recorded highest pruned biomass amongst all the treatments during backward and forward pruning. At bud differentiation stage K content varied significantly among different treatments. Treatment T2 had significantly higher K content in petiole. The potassium application usually starts 45 days after pruning, which generally coincides with petiole sampling, hence, there was variation in the K content of petioles between the treatments. At full bloom stage, all the treatments had optimum nutrient content and there were no significant differences amongst the treatment. The results were commensurate with earlier findings of 60 % savings through fertigation in last three years experimentation.

Table 12. Treatment details for fertigation schedule at different stages of growth

Stages	N	P	K
Bud differentiation stage (Per cent distribution of nutrients)			
April Pruning			
Pre-differentiation	30	-	-
Differentiation	-	60	-
Post-differentiation	-	-	30
Full bloom stage			
Pre-bloom	30	-	-
Bloom set & shatter	-	30	-
Berry growth to veraison	30	-	30
Veraison to harvest	-	-	30
After harvest	10	10	10

Treatment	Description
T1	80% NPK through drip
T2	60% NPK through drip
T3	40% NPK through drip
T4	100% NPK (Direct Soil application)

Table 13. Effect of treatments on the brix yield, yield and pruned biomass

Treatments	Yield (t/ha)	Brix yield (t/ha)	Pruned Biomass (t/ha)	
			October	April
T1	30.60	12.46	2.062	4.160
T2	31.37	12.72	2.170	4.500
T3	27.38	11.39	1.667	3.353
T4	26.84	11.37	1.632	3.209
SEM ±	3.23	1.29	0.152	0.308
CD at 5%	NS	NS	0.461	0.929

J. Effect of sources and level of iron on the nutrition and productivity of grapes
(*J. Sharma and A.K. Upadhyay*)

This experiment was initiated in 2002 on one year old Thompson Seedless vines grafted on Dogridge rootstock with Ferrous sulphate applied through cow dung slurry, Ferrous sulphate applied with humic acid, and iron in chelated form for improving the iron use efficiency. Twenty five per cent of the annual dose was applied during foundation pruning and remaining during fruit pruning in 2 and 3 equal split doses respectively. The vines were irrigated as per schedule. No significant differences were observed

Table 14. Petiole nutrient contents under fertigation treatments

Treatment	Bud differentiation stage			Full bloom stage		
	N (%)	P (%)	K (%)	N (%)	P (%)	K (%)
T1	0.996	0.419	0.94	0.996	0.495	2.17
T2	0.968	0.415	1.23	0.968	0.480	2.10
T3	0.973	0.419	1.12	0.973	0.461	2.08
T4	0.940	0.415	1.01	0.940	0.480	2.00
SEM ±	0.026	0.012	0.033	0.026	0.018	0.06
CD at 5%	NS	NS	0.100	NS	NS	NS

amongst the treatments with respect to yield as well as petiole Fe content (Table 15). Though the application of iron improved Fe content of the petiole, however, this was not reflected on the yield.

Table 15. Effect of iron on nutrition and yield of grapes

Treatment	Yield (kg/vine)	Petiole Fe content (ppm)	
		45 DAP*	100 DAP*
FeSO4 @ 37.5 kg/ha	3.48	41.33	54.33
FeSO4 @ 50 kg/ha	3.90	40.33	57.67
FeSO4 @ 37.5 kg /ha applied through cow dung slurry	4.47	43.33	56.67
FeSO4 @ 50 kg /ha applied through cow dung slurry	3.53	42.33	55.00
Fe EDDHA @ 2.5 kg/ ha	4.00	44.33	58.33
Fe EDDHA @ 5.0 kg/ha	4.70	41.33	55.27
FeSO4 @10kg/ha + 2.5 L Humic Acid	3.93	42.00	59.67
FeSO4 @20kg/ha + 2.5 L Humic Acid	4.14	39.33	57.33
Slurry	3.80	35.00	48.67
Humic acid	3.63	36.67	47.54
CD at 5%	NS	NS	NS

K. Rationalization of fertilizer inputs for grafted Tas-A-Ganesh / Thompson Seedless grapes

(J. Sharma and A.K. Upadhyay)

Rootstocks influence the nutrient uptake pattern of the scion. Present recommendation of 660 kg N: 880 kg P_2O_5: 660 kg K_2O/ha/year is based

on nutrient requirement of own rooted vines in Maharashtra State. As no separate recommendations exist for grafted vines, this experiment was planned to rationalize the major nutrient inputs (N, P and K) to the crop. The experiment was initiated in 2003 on two-year-old Tas-A-Ganesh grapes grafted on Dogridge rootstock. The treatment details are given below:

Treatment	Per cent of recommended dose		
	N	P	K
T1	100	100	100
T2	75	75	75
T3	50	50	50
T4	75	75	50
T5	50	75	50
T6	75	50	50
T7	50	50	75
T8	75	50	75
T9	50	75	75
T10	Absolute control		

Present recommended: 660 kg N : 880 kg $P_2 0_5$: 660kg $K_2 0$/ha/ yr

The data on yield and yield attributes are given in table 16. Brix yield and yield did not vary significantly between the treatments. This is first year data and the yield of the vines is generally affected by the practices followed in the previous year. No significant differences were observed amongst treatments with respect to nitrogen and phosphorus content of the petiole at both the stages of sampling (table 17). Petiole K content at both the stages of sampling differed significantly between the treatments. The potassium application usually starts 45 days after pruning, which generally coincides with petiole sampling, hence, there was variation in the K content of petioles between the treatments. However, the differences were not reflected on the yield.

L. Use of rootstocks for improving water use efficiency in grapes (*A. K. Upadhyay and J. Sharma)*

This experiment was initiated in 2002 on a two years old Tas-A-Ganesh vines grown on their own roots and compared with those grafted on Dogridge (*Vitis champini*) and 110R (*Vitis berlandieri* × *Vitis rupestris*) at three irrigation treatments viz. 50 %, 75 % and 100 % of the recommended irrigation level based upon pan evaporation rate. Treatment details are given in table 18A.

Both the rootstocks produced significantly higher yield and brix yield than own rooted vines at all the levels of irrigation (table 18B). Higher pruned biomass at both the prunings was found in case of rootstocks at all irrigation levels. Both the rootstocks did not differ significantly among themselves in terms of yield and quality at all the levels of irrigation. However, highest yield was recorded with vines grafted on 110 R rootstock. The results demonstrate the importance of rootstocks for higher productivity under saline and scarce water conditions.

Table 16. Effect of treatments on brix yield, yield and pruned biomass

Treatments	Yield (t/ha)	Brix Yield (t/ha)	Biomass (t/ha)	
			October	April
T1	12.74	2.73	1.901	2.869
T2	10.64	2.31	1.650	2.707
T3	12.15	2.41	1.667	2.815
T4	14.83	2.85	1.219	2.564
T5	12.21	2.41	1.901	2.761
T6	7.34	2.51	1.488	2.295
T7	13.17	2.41	1.954	2.707
T8	12.33	2.53	1.650	2.474
T9	10.66	2.17	1.596	2.761
T10	11.76	2.30	1.399	2.241
SEM ±	1.51	0.31	0.176	0.219
CD at 5%	NS	NS	0.520	NS

Table 17. Petiole nutrient contents under different treatments

Treatment	Bud differentiation stage			Full bloom stage		
	N (%)	P (%)	K (%)	N (%)	P (%)	K (%)
T1	0.99	0.26	1.63	0.88	0.31	1.94
T2	0.87	0.26	1.59	0.76	0.31	1.72
T3	0.88	0.25	1.84	0.80	0.32	1.85
T4	0.88	0.23	1.60	0.79	0.32	2.15
T5	0.91	0.26	1.70	0.78	0.34	2.19
T6	0.88	0.26	1.65	0.80	0.31	2.31
T7	0.91	0.22	1.53	0.83	0.27	1.90
T8	0.90	0.23	1.52	0.82	0.29	1.81
T9	0.88	0.24	1.51	0.80	0.33	1.75
T10	0.84	0.26	1.58	0.76	0.35	2.05
SEM±	0.048	0.017	0.07	0.05	0.035	0.16
CD at 5%	NS	NS	0.22	NS	NS	0.47

Table 18A. Treatment details of use of rootstocks

Treatments	
P I irrigation level (50 % of the recommended irrigation level)	
T1	Own root
T2	110 R
T3	Dogridge
P II irrigation level (75 % of the recommended irrigation level)	
T4	Own root
T5	110 R
T6	Dogridge
PIII level (Recommended irrigation level)	
T7	Own root
T8	110 R
T9	Dogridge

Table 18B. Effect of different irrigation levels on the performance of grafted and own rooted Tas-A-Ganesh vines

Treatments	Yield (t/ha)	Brix yield (t/ ha)	Biomass (t/ha)	
			Foundation pruning - October	Fruiting season - April
P I. Irrigation level				
Own root	7.56	1.62	3.712	1.793
110 R	11.14	2.44	5.218	3.676
Dogridge	10.02	2.18	6.311	3.389
P II. Irrigation level				
Own root	11.01	2.29	5.809	2.958
110 R	14.42	3.13	6.706	4.231
Dogridge	13.34	2.93	7.262	4.214
PIII. Irrigation Level				
Own root	13.49	2.91	7.674	3.622
110 R	19.20	4.27	7.710	5.397
Dogridge	17.96	3.98	8.051	5.146
SEM ±	0.53	0.14	0.574	0.215
CD at 5%	1.56	0.42	1.703	0.628

M. Use of mulch and anti-stress for improving water use efficiency in grapes
(A.*K. Upadhyay* and J. *Sharma)*

Presently most of the vineyards in arid and semiarid regions of the country are facing acute water scarcity. Cultural practices like mulch and anti-transpirants can be used to minimize the evapotranspiration losses. However, the information on this aspect is lacking under Indian conditions. The present experiment was started in 2002 on two years old Tas-A-Ganesh vines grafted on Dogridge (*Vitis champini*) using mulch (Bagasse) and anti-transpirant (Antistress). The treatment details are given below:

Treatment details

Treatment	Description
50% of the recommended irrigation level	
T1	No mulch + antistress
T2	Mulch
T3	Antistress
T4	Mulch + Antistress
50% of the recommended irrigation level	
T5	No mulch + antistress
T6	Mulch
T7	Antistress
T8	Mulch + Antistress
T9	Recommended irrigation level

Use of mulch

The treatment, Mulch + anti-stress at 75 per cent of the recommended irrigation level (T8) was on par with the recommended irrigation level (T9), suggesting a saving of 25 per cent of irrigation water (table 19). This treatment was also significantly superior over other treatment combinations at 50 per cent and 75 per cent of the recommended irrigation level in terms of both yield and brix yield. This treatment combination proved to be the best compared to mulch only or antistress only. In general, the treatments intended to minimize evaporation/ transpiration losses produced higher pruned biomass during both the foundation and fruiting season.

N. Use of subsurface method of irrigation for improving water use efficiency in grapes
(A.K. Upadhyay and *J. Sharma)*

This experiment was initiated in 2002 on a two-year-old Tas-A-Ganesh vines. Subsurface irrigation is known to reduce the evaporation losses as the water is applied directly in the root zone. However, in heavy soils laying of perforated pipes/ drip line in subsurface (root zone) is costlier as special kinds of drippers are to be used. In this study the already laid drip

Table 19. Effect of mulch and antistress on the performance of Tas-A-Ganesh vines grafted on Dogridge rootstock.

Treatments	Yield (t/ha)	Brix yield (t/ha)	Biomass (t/ha)	
			Foundation pruning - October	Fruiting season - April
T1	8.72	1.89	4.249	2.976
T2	9.81	2.13	4.267	3.407
T3	10.52	2.29	4.267	3.389
T4	13.00	2.70	4.536	3.658
T5	11.94	2.48	4.895	3.425
T6	14.74	3.07	5.218	4.393
T7	15.27	3.16	5.074	4.178
T8	19.14	3.98	5.576	4.805
T9	21.85	4.62	6.132	5.289
SEM ±	1.063	0.23	0.269	0.269
CD (5%)	3.18	0.68	0.789	0.789

lines were used, PVC pipes (2.5” diameter) with holes on all sides to allow both lateral and vertical movement of water were inserted at a depth of 9” for subsurface irrigation. The water was applied through micro tubes from the dripper in the pipes. The treatment details are given below:

Treatment details

Treatments	Description
50 % of the recommended irrigation level	
T1	Surface
T2	Subsurface
75 % of the recommended irrigation level	
T3	Surface
T4	Subsurface
T5	Recommended irrigation level

Amongst the different treatments, the subsurface irrigation treatment at 75% of the recommended irrigation level (T4) was significantly superior over other treatment combinations at 50% and 75% of the recommended irrigation level in terms of both yield and brix yield (table 20) and this was on par with the recommended irrigation level (T5) suggesting a saving of 25% of irrigation water. The yield declined significantly with the reduction in irrigation level. Subsurface irrigation treatments at 50 and 75% level of irrigation produced higher pruned biomass than surface irrigation treatments at these irrigation levels.

Better performance of vine under sub-surface irrigation at reduced level of irrigation. L - Sub surface irrigation, R - Surface irrigation

Table 20. Effect of subsurface irrigation on performance of Tas-A-Ganesh vines grafted on Dogridge rootstock

Treatments	Yield (t/ha)	Brix yield (t/ha)	Biomass (t/ha)	
			Foundation pruning - October	Fruiting season - April
P I irrigation level				
Surface	12.16	2.61	4.303	2.510
Subsurface	14.39	3.23	6.634	4.124
P II irrigation level				
Surface	16.08	3.42	6.455	3.227
Subsurface	19.19	4.17	6.813	4.841
P III level	17.50	3.99	7.710	4.124
SEM ±	0.77	0.16	0.380	0.197
CD at 5%	2.72	0.49	1.112	0.592

O. Effect of CPPU on bunch and berry development (*S.D. Ramteke* and *R.G. Somkuwar*)

The quality of grapes is determined by berry colour, size, and pulp content. To achieve these qualities various bio-regulators are being used by the growers. Indiscriminate use of CPPU, one of the commonly used bioregulator for this purpose leads to abnormal growth of pedicel and berry scorching. The present experiment was repeated for the third year to study the effect of CPPU on bunch and berry development. The treatment details are given in table 21.

The observations on berry and bunch characters were recorded (table 22). The parameters studied under this trial were differed significantly except TSS and acidity of the berries. The variability in shoot length and leaf area was recorded in different treatments. The variation was also recorded in berry diameter and pedicel thickness. In general, among the treatments, T4 showed the superiority over rest of the treatments. However, the treatment T1 was also on par with T4. Therefore, it can be concluded that to achieve berry quality by using CPPU the number of leaves available per bunch (overall leaf area of the vine) should be at least 10 or more above the bunch. No abnormalities due to application of CPPU were found in any of the treatments.

Table 21. Details of CPPU application

Treatment	CPPU concentration	Number of leaves available per bunch
T1	1 ppm	> 10 leaves above the bunch
T2	1 ppm	7-10 leaves above the bunch
T3	1 ppm	3-6 leaves above the bunch
T4	2 ppm	>10 leaves above the bunch
T5	2 ppm	7-10 leaves above the bunch
T6	2 ppm	3-6 leaves above the bunch.

P. Enhancement of the GA efficacy by different adjuvants (*S.D. Ramteke* and *R.G. Somkuwar*)

To enhance the efficacy of GA_3 the pH of the solution was adjusted to 3.0 - 3.5, 5.5 - 6.0, 6.0 - 6.5 and 6.5 - 7.0 either with citric acid, phosphoric acid or urea phosphate. These solutions were sprayed on Thompson Seedless vines.

The berry size and berry weight was generally higher in treatments where urea phosphate and phosphoric acid was used as adjuvant, with the maximum at pH 6.0 - 7.0. The compactness ratio also varied significantly among the different treatments with the highest ratio obtained with GA_3 solution at pH 6.0 - 7.0 with phosphoric acid.

The use of phosphoric acid and urea phosphate are found to be beneficial when they are used in acidic range (3.0 - 6.0 pH) especially for increasing the diameter, average berry weight, sugar content in berries and also to produce well filled bunches.

Table 22. Effect of CPPU on berry and bunch characters in grapes

Treatment	Berry Diameter (mm)	50 Berry Weight (g)	Mean bunch weight (g)	Shoot length (cm)	Pedicel thickness (mm)	Leaf area (cm2)	TSS (°B)	Acidity (%)	Skin thickness (mm)
T1	20.5	153.0	368.2	158.2	2.03	158.6	14.9	0.51	20.36
T2	19.5	132.5	254.1	147.6	2.07	89.2	13.5	0.49	23.90
T3	18.6	108.6	239.2	65.4	1.74	76.4	14.5	0.51	19.60
T4	19.8	144.8	322.6	171.2	2.09	145.8	14.1	0.49	24.60
T5	19.2	147.1	255.2	147.8	1.88	89.2	14.1	0.52	19.8
T6	19.4	134.4	233.5	61.0	1.94	69.0	13.8	0.53	19.90
SEM ±	0.32	6.07	12.7	5.18	0.13	7.04	0.27	0.01	0.34
CD at 5%	0.97	18.25	37.4	15.3	0.40	20.7	NS	NS	1.01

Q. Use of bio regulators to improve the quality of Sharad Seedless grapes

(S.D. Ramteke and R.G. Somkuwar)

An experiment was conducted to standardize the dose of GA_3 and 6-BA at 3-4 mm and 6-7 mm berry size stages after berry set. The treatment details are given in table 23. The data on bunch and berry characters are presented in table 24.

Table 23. Treatment details

Treatments	Berry growth stage			
	3 – 4 mm		6-7 mm	
	GA_3 (ppm)	6 BA (ppm)	GA_3 (ppm)	6 BA (ppm)
T1	30	10	30	10
T2	40	10	30	10
T3	50	10	30	10
T4	30	20	30	10
T5	40	20	30	10
T6	50	20	30	10

The significant differences were recorded in berry characters like 50-berry weight and berry size (diameter and length).

The data indicated that the application of GA_3 @ 40 ppm + 10ppm 6BA at 3-4 mm and GA_3 @ 30 ppm + 10 ppm 6BA at 6-7 mm berry size stage were as good as higher concentration of GA_3 .

Table 24. Effect of bio-regulators on bunch and berry characters

Treatments	50-berry weight (g)	Berry length (mm)	Berry diameter (mm)	TSS (°B)	Acidity (%)
T1	121.5	17.9	15.36	19.8	0.68
T2	144.3	19.2	16.24	20.4	0.59
T3	136.2	19.1	15.54	19.7	0.60
T4	137.0	19.9	15.60	18.8	0.61
T5	144.5	19.9	15.96	19.0	0.65
T6	148.0	20.1	16.72	19.3	0.66
SEM ±	5.8	0.45	0.25	0.69	0.03
CD at 5%	17.1	1.33	0.75	NS	NS

3-4 mm berry stage

The observations on berry quality and shelf life were recorded. The significant differences among the treatments were recorded for 50-berry weight and berry diameter. The maximum berry weight and berry diameter were recorded in T3, T4 and T6 were also on par with respect to 50-berry weight. Other berry characters and shelf were not affected by differences in treatment.

Based on above observations it could be concluded that for increasing berry size and berry weight of Sharad Seedless grapes the application of GA_3 @ 40 and 30 ppm along with 10 ppm 6BA at 3-4 mm and 6-7 mm berry size stage respectively is beneficial and economical. No significant differences were observed in keeping quality.

U. Bioregulators for improved performance of wine varieties

Standardization of dose of hydrogen cyanamide in important wine varieties

(*S.D. Ramteke* and *R.G. Somkuwar*)

6-7 mm berry stage

The wine varieties are basically seeded varieties, that contains endogenous auxins. Not much use of bioregulators is recorded. However, for proper berry development, and bud sprouting, use of growth regulators and chemicals like hydrogen cyanamide helps at initial stage. Hence, an experiment was initiated to study the requirement of bioregulators for improving performance of wine varieties. The experiment was conducted at the vineyards of M/s Champagne India Pvt. Ltd., Narayangaon, Pune. Preliminary observations indicated that although some wine varieties are self sprouting, however, most of the wine varieties require application of bud breaking chemicals like hydrogen cyanamide for uniform bud sprouting. The experiment to standardise the dose of application of hydrogen cyanamide is in progress.

Similarly experiments to study the effect of GA_3 on the performance of different wine varieties was initiated and is in progress. The results of these experiments will be available after one more year of observation.

Plant Protection

I. Diseases

(S.D. Sawant and Indu S. Sawant)

A. Demonstration of diseases management using Metwin 2 for downy mildew and anthracnose

Demonstration of the management of downy mildew and anthracnose using disease forecasting software Metwin 2 was conducted for the third consecutive year. The number of sprays given in spray schedule based disease management and forecasting based disease management are given in table 25. During the fruiting season there was no possibility of the outbreak of the downy mildew and anthracnose in the vineyard area, hence there was no difference in the number of sprays given for the control of these diseases. However, results of Metwin 2 gave right advice not to spray for these diseases during most part of the season.

B. Testing cum demonstration of model developed at NRC for Grapes for forecasting and management of powdery mildew

The model was developed based on the data collected over the last three years. The correctness of the model was critically observed for one year and the first practical demonstration was held during fruiting season 2003-04. The model uses observations on daily minimum and maximum temperature and relative humidity and gives daily risk of disease as Nil, Low, Medium and High. The decision on action required for management of the disease is taken after considering the vine growth stage.

Table 25. Saving of pesticide sprays due to disease forecasting based management (October 2003 - March 2004)

Diseases	Schedule based management			Disease forecasting based management		
	System-ic	Non System-ic	Total	System-ic	Non system-ic	Total
Metwin 2 model						
Downy mildew	0	0	0	0	0	0
Downy mildew and Anthracnose	0	1	1	0	1	1
Anthracnose	0	0	0	0	0	0
NRCG Model						
Powdery mildew	6	2	8	3	1	4
Total	6	3	9	3	2	5
Saving of Sprays	-			**3**	**1**	**4**

As indicated in table 25, total 8 sprays were given under schedule based management however, only 4 sprays were required for management based on disease forecasting based management. This means 4 sprays were saved during the fruiting season using forecasting model for powdery mildew developed at NRCG.

C. Bio-efficacy of Bi-carbonates for control of powdery mildew in grapes

In the field experiment potassium bi-carbonate (PBC) was tested alone and in combination with hexaconazole or surfactant for second successive year. PDI of powdery mildew on leaves and bunches were recorded. When used alone PBC at 1 per cent concentration showed better control than 0.5 per cent. The level of disease control was improved when used in combination with surfactant, and on leaves it was on par with that achieved by sulphur 0.2 per cent. PBC 0.5 per cent was tested in combination with hexaconazole 0.05 per cent and/or surfactant. PBC 0.5 per cent + hexaconazole 0.05 per cent showed significantly better control than hexaconazole 0.05 per cent. Based on the data it was concluded that for better management of powdery mildew, PBC 0.5 per cent can be used in combination with hexaconazole 0.05 per cent.

D. Bio-efficacy of chitosan alone or in combination of biocontrol agents in control of diseases in Grapes

Chitosan alone or in combination with bio-control agents *Trichoderma* and/or *Verticillium,* or KH_2PO_4 showed significant decrease in PDI on leaves as well as bunches as compared to that in case of Control. When chitosan was used alone, PDI on leaves and bunches was significantly decreased when concentration was increased from 0.1 to 0.2 per cent. Chitosan 0.1 per cent when used in combination with *Trichoderma* or *Verticillium* or both there was significant decrease in PDI on leaves and bunches, maximum decrease being in case of chitosan in combination with *Trichoderma* and *Verticillium*. Similar decrease in PDI was also observed in case of treatments where chitosan was used in combination with KH_2PO_4 and *Trichoderma*. When chitosan or KH_2PO_4 was used alone PDI on leaves was significantly more than that in sulphur, while when chitosan was used in combination with KH_2PO_4 and biocontrol agents *Trichoderma*, the PDI on leaves was on par with that in sulphur. PDI on bunches in all the treatments was significantly higher than that in sulphur. However, significantly higher yield over control was observed in all treatments except in case of KH_2PO_4, sulphur and chitosan in combination with *Trichoderma*.

Results indicate that chitosan in combination with biocontrol agents like *Trichoderma* and *Verticillium* or in combination with KH_2PO_4 has potential to reduce the powdery mildew in grapes and it can be exploited whenever the disease risk is low in vineyards.

E. Exploration of unconventional chemicals for the control of diseases

Various unconventional substances *viz.* gomutra, milk and KH_2PO_4 were tested for their potential for control of powdery mildew. The experiment was conducted in bower block after forward pruning. Results indicated

that sprays of fermented gomutra 10 per cent and pasteurized milk 10 per cent gave good control of powdery mildew. The results were comparable with the control of the disease achieved by the sprays of sulphur 2g / L. The sprays of KH_2PO_4, and formulation containing 0.03 per cent azadirachtin reduced powdery mildew. However, the control achieved was lower than that in case of sulphur.

Infestation of thrips was observed in all the plot, but the plants treated with fermented gomutra were free from thrips infestation.

Leaves and bunches of plants treated with milk and gomutra were analysed in the laboratory for total microflora. Gomutra treated leaves and bunches consistently showed the presence of one yeast in abundant numbers. The yeast was isolated in pure culture and is being maintained for further study.

F. Effect of chitosan spray with or without *Trichoderma* sprays on post harvest decay of cold stored grapes

Control of post-harvest decay in grapes stored at 0 ± 0.5 ^{0}C, by pre-harvest sprays of chitosan @ 1.0, 0.5 and 0.25 g per litre alone or in combination with Trichoderma harzianum 5R @ 1 x 10^6 CFU per ml was studied. Chitosan and T. harzianum 5R alone or as a tank mix were sprayed 20 and 7 days before harvest. Before storage at low temperature grapes were packed with sodium metabisulphite (as in-package sulphur dioxide generator) @0.0, 2.3 or 3.5g per 5 kg grapes. Observations on various parameters of decay and desiccation were recorded after 30 days of storage.

Based on the freshness of the fruits, rotten berries, fallen berries and the PLW (< 5 per cent), pre harvest treatment with chitosan @1.0 g/l and packing the grapes with 3.5 g sodium meta-bisulphite enhanced the shelf life of cold stored grapes by four days as compared to the 3.5g sodium meta-bisulphite control.

II. Insect Pests

A. Roving survey for incidence of insect pests on grapes *(Narendra Kulkarni)*

Different areas of Maharashtra and Andhra Pradesh were surveyed between November - February 2003 to study the seasonal incidence of important insect pests in growers' vineyards and details are given in table 26. During the observation period, no incidence of flea beetle was noticed in all the areas surveyed. However, heavy incidence of thrips and jassids was noticed in all the areas and their population was above Economic Threshold Level (ETL) i.e. 3-4 adults or nymphs / shoot (Table 26).

Mealy bug population was sporadic and its population was above ETL in Hyderabad, Solapur and Nasik areas (minimum average of one to two colonies / vine). Whereas, in Solapur and Latur areas, low incidence of caterpillars was noticed which was below ETL (Minumum 1-2 caterpillars / vine and did not warrant any management strategies.

Mealy bug

B. Fixed plot survey
(Narendra Kulkarni and S.D. Sawant)

Flea beetle

Seasonal incidence of insect pests was observed during October 2003-April 2004 in the Centre's grape vineyards at regular intervals. Weather parameters namely maximum and minimum temperature, relative humidity and rainfall were also recorded at the time of observation. Flea beetle population was observed after pruning i.e. from October which prevailed up to December with the highest beetle population of (5.4/ vine) during fourth week of October (43rd Indian Standard Week) (Table 27).

Heavy incidence of thrips and jassids was observed throughout the season and very high population peaks were observed during 45 to 51st ISW (November and December months) with the highest population of thrips (16.2 / shoot) on 47th ISW. High incidence may be due to favourable environmental conditions like lesser rains and warm weather with bright sunny days. These weather conditions also favour jassids and therefore, heave incidence of jassids was observed between 47th ISW to 1st ISW with the highest population on 48th ISW (last week of November).

Thrips

Mealy bug population was low and its distribution was sporadic during the entire season. The number of colonies ranged from 1 to 1.2/vine during December and January. Similarly mite population was seen during December to February months and highest peak of 5.4/shoot was observed during second week of January which coincided with dry and warm weather.

C. Documentation of indigenous methods of pest management
(Narendra Kulkarni)

Different indigenous methods adopted by the farmers for the management of insect pests as well as pattern of insecticide use by them were documented (Table 28). Farmers are following different cultural, mechanical, physical, biological and chemical methods for managing insect pests in grape vineyards. Farmers are practicing both preventive as well as curative methods of pest management. Most of the farmers, selling their produce in the local market depend heavily on chemical pesticides for immediate control. However, farmers who export their produce are very cautious about the use of pesticides. It was also observed that some farmers are using pesticides which are not approved for use in grapes in India.

Table 26. Seasonal incidence of insect pests in important grape growing areas during October 2003-April 2004

ISW	Month / period	Location	No.of thrips / shoot / vine	No of jassids / shoot / vine	No.of mealybug colonies / vine	No.of *Heliothis*/ vine
47	09-11-2003	Solapur	6.4	2.2	2.4	1.2
		Latur	5.8	1.6	1.8	0.8
	19-11-2003	Junnar	3.2	1.4	0.0	0.6
		Narayangao-n	4.8	2.6	0.0	0.4
	21-11-2003	Pandharpur	2.2	-	-	-
		Kasegaon	4.2	-	-	-
50	14-12-2003	Ahmednagar	3.4	0.8	0.0	0.2
	15-12-2003	Nasik	4.2	2.4	0.0	0.0
	16-12-2003	Around Nasik	5.8	1.8	0.8	0.0
52	23-12-2003	Hyderabad	6.4	4.8	0.8	0.0
	24-12-2003	Rangareddy	8.8	5.2	0.4	0.0
		Medchal	10.6	6.4	0.2	0.0
		Medak	9.4	4.8	1.2	0.0
		Tukkuguda	12.6	4.2	2.6	0.0
1	06-01-2004	Narayangao-n	4.8	2.6	2.8	0.0
3	19-01-2004	Narayangao-n	3.6	1.8	3.2	0.0
5	24-02-2004	Hyderabad	6.2	3.6	0.8	0.0
	25-02-2004	Rangareddy	5.4	2.2	0.4	0.0

Table 27. Seasonal incidence of insect pests in grape vineyards at NRC for Grapes, Pune and prevailing weather conditions (October 2003 - April 2004)

ISW	Month/ period	No.of flea beetle/ vine	No.of thrips/ shoot/ vine	No of jassids/ shoot/ vine	No.of mealybug colonies/ vine	No.of mites/ shoot/ vine	Rain (mm)	Min temp (°C)	Max temp (°C)	Relative Humidity (%)	
										Morning	Afternoon
40	1-7 Oct	2.8	3.2	0.0	0.0	0.0	0.6	18.0	33.6	100	50
41	8-14	3.6	3.8	0.0	0.0	0.0	0.0	19.9	34.6	100	47
42	15-21	3.2	4.2	0.0	0.0	0.0	0.4	17.1	35.0	100	34
43	22-28	5.4	4.6	0.8	0.0	0.0	0.0	15.3	37.1	97	29
44	29-4 Nov	2.8	6.8	1.2	0.0	0.0	0.2	20.1	32.1	99	53
45	5-11	2.2	10.2	2.2	0.0	0.0	2.0	15.6	31.6	97	35
46	12-18	3.0	14.8	1.8	0.4	0.0	0.2	16.0	31.0	97	42
47	19-25	2.2	16.2	4.6	0.6	0.0	0.8	14.9	30.9	98	40
48	26-2 Dec	1.6	15.4	8.4	0.8	0.0	0.4	12.9	31.7	100	36
49	3-9	1.8	14.8	6.2	0.2	0.0	0.8	11.2	30.1	99	31
50	10-16	0.8	12.2	6.0	0.8	0.8	0.2	10.3	30.1	100	30
51	17-23	0.6	10.8	5.6	1.0	1.2	0.8	9.0	29.0	100	30
52	24-30	0.2	9.2	4.8	1.2	2.2	0.2	11.0	29.1	100	45
1	31-6 Jan	0.2	9.4	5.0	0.8	3.4	0.0	10.3	30.0	100	34
2	7-13	0.2	8.4	3.8	0.6	5.4	1.2	9.0	28.7	100	36
3	14-20	0.0	8.8	4.2	1.0	3.8	0.2	10.0	32.9	99	29
4	21-27	0.0	6.8	3.4	1.2	4.6	0.0	10.7	28.6	100	42
5	28-3 Feb	0.0	6.2	3.6	0.8	4.2	0.6	12.4	28.9	99	42
6	4-10	0.0	4.2	2.2	0.4	3.2	0.2	9.0	31.4	93	25
7	11-17	0.0	4.4	2.0	0.2	1.8	0.4	12.1	33.1	93	26
8	18-24	0.0	4.0	2.4	0.2	0.8	0.2	12.1	35.6	92	20
9	25-2 Mar	0.0	4.2	1.8	0.4	1.2	1.0	13.4	36.6	85	18
10	3-9	0.0	3.2	2.0	0.0	0.4	0.0	14.2	38.0	72	14
11	10-16	0.0	3.6	1.4	0.0	0.2	0.2	13.7	38.0	71	14
12	17-23	0.0	3.0	1.8	0.0	0.0	0.2	15.7	40.0	72	10
13	24-30	0.0	3.4	2.0	0.0	0.0	0.2	18.0	38.0	71	15
14	31-6 Apr	0.2	3.2	1.8	0.0	0.0	0.0	19.3	38.6	85	19
15	7-13	0.4	3.0	1.6	0.0	0.0	0.0	17.3	38.0	82	17
16	14-20	0.8	3.8	2.0	0.0	0.0	0.0	18.7	37.7	67	20
17	21-27	1.2	2.2	0.6	0.0	0.0	0.2	21.3	38.4	66	27
18	28-3 May	1.6	1.8	0.0	0.0	0.0	0.2	21.6	38.6	60	19

D. Screening of grape germplasm for incidence of insect pests *(Narendra Kulkarni and G.S. Karibasappa)*

More than 300 grape varieties and accessions maintained in Centre's germplasm were screened for the presence of insect pests and their damage. Observations were recorded on shoot tip, matured shoot and berries. The varieties were rated on a scale of 1-10, and promising varieties/ accessions showing lesser insect attack as well as highly susceptible varieties were short listed and are given in table 29.

Varieties/ accessions such as Tannat, Khalili, Lake Emerold, Malvasia Binca de Vaporis and Pivot Noir showed least insect pest attack and these varieties/ accessions may be exploited for breeding insect pest resistant varieties. Varieties / accessions such as Thomson Seedless, Kishmish Belyi, 2A Clone (TS), Coarna Regia, EC 36506, Pusa Urvashi, and Superior were found most susceptible to insect pest. It was observed that most of the table grape varieties were more susceptible to insect pests compared to wine varieties.

Scale	% damage	Damage symptoms	Code
0-1	10	Very low/ Negligible	N
1-2	20	Low	L
2-3	30	Medium	M
3-4	40	High	H
4-5	50	Very High	VH
5-6	60	Severe	S
6-7	70	Very severe	VS
7-8	80	Epidemic	E
8-9	90	Outbreak	O
9-10	100	100% Loss	100%

Ratings

Collaborative and Externally Funded Projects

A. Micro-propagation of selected grape varieties and rootstocks and DNA finger printing of grape germplasm (DBT funded project in collaboration with NCL, Pune and ARI, Pune) *(G.S. Karibasappa)*

Micropropagation of varieties like Red Globe, Crimson Seedless and 2A Clone of Thompson Seedless were continued. Rootstocks like 110 R and 1103 P were also included in the studies. Nodal segments and shoot tips were collected from field grown plants maintained at Centre's germplasm for use as explant for micropropagation.

Table 28. Different indigenous methods as well as commonly used insecticides in grape vineyards by farmers

Sl No.	Insect	Damaging Stage	Integrated Methods of Management					
			Cultural	Mechanical	Physical	Biological	Chemical	Others
1.	Flea Beetle *Scelodonta strigicollis*	Grub & Adult	___	i. Removal of loose bark and rubbing the stems with jute cloth . ii. Putting bundles of dry shreds of banana on the pruned end of the vines in the evening. Beetles, which take shelter on these at night, are shaken and collected in the morning and killing them by putting in buckets containing water mixed with kerosene.	___	___	1. Carbaryl @ 0.15% 2. Malathion dust & EC 3. Chlorpyriphos dust & EC 4. Imidacloprid 5. Thiamethaxam	
2.	Mealy bug *Maconellicoccus hirsutus*	Nymph & Adult	___	i. Removal of loose bark and rubbing with jute cloth. ii. Applying sticky bands like 'Track-trap' or 'Bird Tangle Foot' on arms or on main stem. iii. Removal of alternate host plants like custard apple, hibiscus, guava, bhendi, mulberry and cotton. In unavoidable cases releasing ladybird beetles on		i. Releasing Australian lady beetle *Cryptolaemus mountrazeri* @ 1000-1500 per acre ii. *Verticillium lecanii* @ 5 gm or ml	1. Dichlorvos 2. Carbaryl 3. Chloripyriphos 4. Methomyl 5. Thiamethaxam 6. Endosulphan 7. Phosalone 8. Acephate	1. Neem based pesticides 2. Cal MB 3. Praghat+ 4. Turmeric powder @ 5%

				them. iv. Destroying ant colonies by putting kerosine and burning				
3.	Thrips *Rhipiphorothrips cruentatis* *Scirtothrips dorsalis*	Nymph & Adult	Balanced application of nitrgenous fertilizers and judicious use of irrigation	Application of yellow sticky bands 2-3 per acre		*Verticillium lecanii* @ 5 gm or ml	1. Neem based pesticides 2. Oxydemeton methyl 3. Dimethoate 4. Quinolphos 5. Pipronil(Regent) 6. Lamda cyhalothrin 7. Thiamethaxam 8. Spinosad 9. Acephate 10. Fenvelarate 11. Monocrotophos	1. Gomutra 10%
4.	Stem borers *Celosterna scabator*	Grub & adult	___	Making a hole and removing grub by piercing with barbed wire and killing.	Light trap	___	1. Dichlorvos 2ml/vine 2. Aluminium phosphide tablet 3. Chlorpyriphos	
5.	Termites or white ants	Adult workers	___	By Locating the termite nests or termatorium and destroying them by removing queen termite out.	___	___	1. Chorpyriphos 2. Soil application of Chlorpyriphos (0.2 %) dust @ 10 kg /ac 3. Dichlorvos 4. Aluminium phosphide	
6.	Caterpillars	Larvae	Deep ploughing in summer	Collection & destroying egg masses	Light trap & pheromone trap	Helicoverpa Nuclear Polyhedrosis Virus (HNPV)	1. Chlorpyriphos 2. Phosalone 3. Quinalphos 4. Acephate 5. Profenphos 6. Lamdacyalothrin	5 % Neem Seed Kernal Extract (NSKE)

Table 29. Screening of grape germplasm for presence of insect pests and their damage

Grape variety	Rating (0-10)			Average rating	Category	Insects noticed
	Shoot tip	Matured Shoot	Berries			
Tannat	0	1	1	0-1	N	-
Khalili	0	1	0	0-1	N	-
Kali Sahebi	7	5	4	5-6	S	T
Lake Emerold	1	0	0	0-1	N	A
Malvasia Binca de Vaporis	1	0	0	0-1	N	J
Anab-E-Shahi (Seedless)	7	5	4	5-6	S	T,J
Kishmish Belyi	7	7	5	6-7	VS	T+J
Loose Perlette	6	5	4	5-6	S	T,J
2A clone (TS)	8	8	5	7-8	E	T,J
A 18-2 (19/20)	7	6	4	5-6	S	T,J
Thomson Seedless	7	6	4	5-6	S	T,J
Coarna regia	7	6	5	6-7	VS	J,T
Babeasca naegra	8	5	4	5-6	S	T,J
EC 36506	9	8	5	7-8	E	T,J
Sultana seedless	6	6	3	5-6	S	T,J
Pusa urvashi	8	8	-	8-9	O	J
Pivot Noir	1	1	0	0-1	N	J
TS	7	6	4	5-6	S	J
Superior	8	7	3	6-7	VS	J,T,A

A - Aphids CB - Chaffer beetle FB - Flea beetle J - Jassids
LM - Leaf miner T - Thrips WF - White fly

The tissue cultured plants from different varieties were successfully established in soil under green house conditions. The success rate for Red Globe, Crimson Seedless and 2A Clone of Thompson Seedless was 94, 100 and 95 per cent respectively. The protocol for micro propogation of rootstocks is yet to be standardised.

In vitro plantlets in poly house

B. Sustainable management of agro-biodiversity - augmentation and evaluation of grape germplasm (NATP funded project) - Final report

(G.S. Karibasappa)

Through augmentation from various grape research centres, grape growers and private wineries in the country the Centre has collected 10 varieties, 47 hybrids, 25 cultivars, 21 clonal selections/mutants and 7 related species. Similarly, through explorations, 10 cultivated types, 2 edible species from Kinnaur area of Himachal Pradesh and three wild relatives from Upper Konkan Region have been collected and maintained as an active field germplasm. The germplasm collection at the Centre has 112 indigenous accessions.

Sixteen shoot tip characters, three bunch and 11 berry quantitative and qualitative characters have been studied for characterization of various grape varieties according to UPOV descriptor recommended for grape. Ampelographic characterization included 230 accessions.

Pusa Navrang, a teinturier variety suitable for juice making gave consistently two crops per year on both prunings and yielded 9.5 kg and 16.5 kg fruits per vine from back and fore pruning respectively. Juice extraction and analysis was carried out from 8 varieties. Country Bangalore and Marroo Seedless gave 90 per cent juice recovery followed by Gulabi x Bangalore Purple(87.5%), S x R (88.0%) and Pusa Navrang. Pectin content in the raw juice was lowest in Country Bangalore (310 mg /L), Walthom Cross (378 mg/L), Gulabi x Bangalore Purple (416 mg/L), S x R (430 mg/L), Marroo Seedless (467 mg/L) and Pusa Navrang (493 mg/L).

Among 23 wine varieties of both indigenous and exotic types, Arka Soma had maximum fruit yield (22.50 kg/vine) followed by Ugni Blanc (17.88 kg/vine), Angur Kalan (16.42 kg/vine), Chenin Blanc (16.30 kg/vine) and Grenache (15.83 kg/vine). Other wine varieties such as Cabernet Sauvignon (10.22 kg/vine), Carignane (14.53 kg/vine), Merlot (8.68 kg/vine), Shiraz (14.18 kg/vine) were also promising.

Field screening of varieties against downy mildew indicated high tolerance to the disease in EC 27818, Pearl of Csaba, EC 32473, EC 36537, EC 36915, EC 36587, and EC 20627. Whereas Jaffayam found to be resistant, Neagra Vertis, Julesky Muscat and EC 36506 were moderately resistant.

Varieties *viz.* PS-11-1, Pearl of Csaba, Olympia, Carignane, Sauvis-365, H-533, Jaffayam, White Sweet, Tannat, Arka Hans, Bhokri, Banqui Abyad, E 2/7, Julesky Muscat, Armas, Katta Kurgan, Large White, Burkland Sweet Water, Sundekhani (seeded), Rose Ciotet, Azabella, Loose Perlette and H-87(*V.lanata* x Cheema Sahebi) were found to be resistant to powdery mildew under field conditions at the Centre.

All the 10 indigenous accessions collected from Kinnaur (Himachal Pradesh), such as Choultu Black, Choultu White, Rangspey Black, Rangspey White, Choultu Red, Kinnauri-1, *V.parviflora, V.lanata*, Kanai local and Ribba black have been found immune to powdery mildew under field conditions at Pune.

Out of 5 male sterile lines *viz.* Madelien Angevine, Arka Trishna, Spin Sahebi, Katta Kurgan and *V. parviflora* the latter 3 male sterile lines have been used for mass breeding program especially to incorporate seedless trait with downy mildew resistance in the hybrids.

C. Induction of downy mildew resistance in commercial cultivars of grapes through cross breeding and *in vitro* embryo rescue methods (NATP funded project in collaboration with NCL, Pune, ARI, Pune)
(G.S.Karibasappa)

During the year the Centre received 585 hybrid seedlings raised through embryo rescue at NCL. The hybrids belonged to both the female parents (Thompson Seedless and Flame Seedless) crossed with 8 male parents.

Embryo rescued plantlets

After 6 months of soil planting in greenhouse, 86.8 per cent progenies of Thompson Seedless and 77.8 per cent progenies of Flame Seedless survived. Crosses of Thompson Seedless with Sevye Villard, Concord and Catawba had a success rate of 40.5, 24.3 and 18.9 per cent respectively and that of Flame Seedless with Catawba, Concord, Lake Emerald and Sevye Villard had success rate of 52.5, 20, 12.5 and 6.3 per cent respectively.

Leaf morphology of hybrids was studied. 43.2 per cent progeny of Thompson Seedless had pentagonal leaves, 24.3 per cent of each had wedge and circular leaves and 8.1 per cent had cordate leaves. Whereas 30 per cent of Flame Seedless progeny had wedge, 27.5 percent had cordate, 22.5 per cent had circular and 17.5 per cent progenies had pentagonal leaves.

D. Studies on Polyphenol contents in grape varieties
(G.S.Karibasappa)

This study was conducted in collaboration with Advanced Centre for Treatment, Research & Education in Cancer, Mumbai with an objective to identify polyphenols in grapes with anticancer properties.

Nine grape varieties were selected to extract polyphenols from whole grapes. Among these varieties four were tested for two years and remaining five varieties for one season. Polyphenol contents varied year wise. The concentration of catechin and procyanidin B_3 also varied year wise. In general, black varieties showed higher polyphenols. Pusa Navrang recorded maximum levels of catechin and procyanidin B_3.

E. Molecular tagging of downy mildew resistance in grapes (DBT funded project)
(Anuradha Upadhyay, G.S. Karibasappa and Indu S. Sawant)

Report presented under section F of Crop Improvement.

F. National Referral Laboratory for Monitoring Pesticide Residues for Export of Fresh Grapes from India

(P.G. Adsule, A.K. Upadhyay, K. Banerjee, S.D. Sawant, R.G. Somkuwar, Anuradha Upadhyay, S.D. Ramteke, N.S. Kulkarni)

Grape from India is being exported to European Union countries besides the countries of the Middle East and the Far East. During the export season of 2002-2003, some of the exported consignments had the pesticide residues more than the maximum residue level (MRL). As a result, European Union ordered testing of pesticide residues in all the consignments. This action led to delay in sale of the produce in the market and also rejection of some consignment. Accordingly, APEDA seized this problem and convened meetings of officials of NRC for Grapes, State Govt. departments, exporters, officials of the phytosanitary department and grape growers in order to deliberate on the existing pesticide monitoring system and its deficiencies. Deliberations in these meetings suggested the newer approach for monitoring the pesticide residues and accordingly the roles of all the pesticide monitoring agencies have been spelt out. APEDA has declared the NRC for Grapes, Pune as the National Referral Laboratory (NRL) for monitoring pesticide residue in fresh grapes for export right from the field to the point of export.

The objective of this project is to establish the surveillance system for monitoring the pesticides residues level of exportable table grapes. To fulfil these objectives, NRL will take up the following activities:

1. It shall draw at least 5 per cent of the samples directly from the recognized pack houses pertaining to the batches tested by the nominated laboratories as a measure of conformity.
2. Monitor the work of nominated laboratories by conducting surveillance audit to ascertain that they are following the criteria laid down under this monitoring system.
3. Evaluate 5 % test data of the samples analysed by the nominated laboratories pertaining to the batches tested by the nominated laboratories as a measure of conformity.
4. To compile residue analysis data of the nominated laboratories for each year and prepare plan of action for the following year.
5. To advise the exporters about the control measures required to be taken in case residue levels are found to be higher than the permitted levels.
6. To organize training on testing for each residue or groups of residues for the nominated laboratories.

Since its initiation in December 2003, the NRL organized (i) orientation programmes for sampling grapes for pesticide monitoring and pesticide usage during last 50 days before the harvest are organised regularly at Pune, Bangalore and Hyderabad for Agricultural Officers/ Horticultural Officers from respective State and officials from APEDA and representatives of nominated laboratories and farmers and (ii) meetings with nominated laboratories to decide standard operating procedure and making them acquainted with sampling procedure in vineyards.

Contract Research Projects

A. Bio-efficacy of Biovita in grapes
(S.D. Ramteke)

The bio regulator, Biovita was tested for its effect on yield, growth and quality parameters of Thompson Seedless. The trial was conducted as per the protocol suggested by the sponsors. It is a liquid concentrate of natural organic product, which contains extract of *Ascophyllum nodusam*. The trial was sponsored by M/s PI industries Ltd., Udaipur.

B. Testing of bio-efficacy of new fungicides for control of mildews
(S.D. Sawant and Indu S. Sawant)

The following new fungicides showed their potential in control of disease in grape in field trials conducted during 2003-04.

Sl. No.	Fungicide formulation	Active ingredient	Dose	Disease controlled	Trial sponsored by
1.	Score 25 EC	Difenoconazole	0.5 ml/L	Powdery mildew	M/s Syngenta India Ltd., Mumbai
2.	Tebuconazole	Tebuconazole 25 EW	0.5 ml/L	Powdery mildew	M/s Indofil Chemicals Company, Mumbai
3.	HP summer tree oil	HP summer tree oil	5 ml/L	Powdery mildew	Hindustan Petroleum Corporation Ltd., Mumbai.

C. Testing of bio-efficacy of new insecticides/ botanicals for control of insect pests
(Narendra Kulkarni and Indu S. Sawant)

The following new insecticides/ botanicals showed their potential in control of insect pests in grape in field trials conducted during 2003-04.

Sl. No.	Insecticide formulation	Active ingredient	Dose	Insect controlled	Trial sponsored by
1.	Actara	Thiamethoxam 25 SG	25 g/100 L	Jassids and thrips	M/s Syngenta India Ltd., Mumbai
2.	Confidor	Imidachloprid	3 ml/10 L	Flea beetle	M/s Bayer Crop Sciences, Pune
3.	Lannate	Methomyl 40 SP	1 g/L	Mealy bug	M/s E.I. DuPont India Ltd., Haryana
4.	Neemazal-T/S	Azadirachtin in 1% EC	2 ml/L	Flea beetle, thrips, jassids, mites	E.I.D. Parry (India) Ltd., Bangalore
5.	Polo	Diafenthiuron 50 EC	2 ml/L	Mites, thrips, jassids	M/s Syngenta India Ltd., Mumbai
6.	Praghat	Herbal extracts of *Neriumodoum* and *Bombax malbaricum*	1 ml/L	Mealy bug	M/s Nature Life Science Pvt.Ltd. Pune

The following technologies have been evaluated at the Centre during the last three years.

Strategies for insect pest and disease management during last 50 days before harvest

In viticulture last 45-60 days before harvest are very crucial in the management of grape insect pests and diseases. Application of pesticides near harvesting time is not recommended in order to avoid possibilities of pesticides residues in the berries. Preventive measures must be taken in such a way that the incidence of pest does not occur when the berries mature. Although recommended plant protection measures take care of vine right from the day of April pruning, however, due to sudden change in weather, incidence of insect pest and diseases may appear during last 30 days before harvest.

While powdery mildew is the main fungal disease, thrips and mealy bugs are important insect pests in the last 60 days, which if not controlled at initial stages can cause enormous damage.

The Centre has developed strategies for management of pests and diseases under such situations. The main features of this strategy are disease forecasting based sprays of fungicides, choice of proper fungicide, integrated insect pest management.

Rootstocks

Performance of Thompson Seedless and Tas-A-Ganesh on Dogridge rootstock and own rooted was compared. The vines grafted on rootstock performed better. Besides better yield and quality, rootstocks provide advantage in adverse conditions like drought, salinity and alkality of soil and water. Rootstocks were found to save up to 25 per cent irrigation water.

Irrigation Schedule

An irrigation schedule based on pan evaporation and plant growth stage has been developed. On farm experiments resulted in 40 per cent saving in water requirement and water use efficiency increased by 114 per cent.

Rationalization of fertilizer use

Growth stage wise fertilizer application through drip resulted in 60 per cent savings in fertilizer use over the conventional method of soil application, thus improving fertilizer use efficiency and reducing soil ill health and pollution of underground water.

Use of mulch and subsurface irrigation

A novel and cost effective method of subsurface irrigation was tested and found effective in reducing water usage by 25 per cent. Similarly, use of mulch has shown to save 25 per cent of irrigation water.

Use of Bio-regulators

Application of several bio-regulators and commercial formulations *viz.* CPPU, Combine, Bioforce, Biopower etc. at various fruit developmental stages resulted in better berry diameter and crispness. The best bio-regulators and their respective concentrations have been worked out.

Disease Forecasting based Disease Management

Usefulness of disease forecasting software Metwin 2, for disease management was evaluated and demonstrated. Disease forecasting based disease management resulted in considerable decrease in number of sprays during one year. This amounts to considerable saving on fungicide and the cost of labour, thus bringing down the overall cost of production. This will also help in reducing the residual levels of pesticides.

The scientists disseminated these technologies to the grape growers through several field visits and participation in growers' seminar.

Farm Visits

- A team of scientists consisting of Dr. P.G. Adsule, Dr. G.S. Karibasappa, Dr. S.D. Sawant and Dr. Jagdev Sharma visited the Rangareddy district of Andhra Pradesh under the awareness programme on production of export quality grapes jointly organized by the APEDA and A.P. grape growers. The team also visited vineyards located in Karimguda, Godamgunta and Yadaram areas on 26th May 2003. Most of the vineyards were facing the problem of water scarcity, since the soils are sandy loam with poor nutrient and water holding capacities. The growers were advised to use more organics like FYM, oil cakes, green manures, composts and addition of tank silt etc. for improving both nutrient and water holding capacity and further improve their use efficiency. The growers were advised to give frequent irrigations with reduced quantity of water to improve both nutrient and water use efficiency.

Scientists interacting with growers during field visit

- During 18-24th May, Dr. P.G. Adsule, Director and scientists Dr. G.S. Karibasappa, Dr. S.D. Sawant, Dr. R.G. Somkuwar, Dr. S.D. Ramteke and Dr. Jagdev Sharma participated in field visits and consultation on the spot under the Project Uptech of SBI at Nasik, Sangli and Solapur and guided the farmers on various aspects of grape cultivation.
- At the instance of Directorate of Horticulture, Govt. of Andhra Pradesh, Hyderabad, Dr. P.G. Adsule along with Dr. R.G. Somkuwar visited vineyards around Ranga Reddy and Hyderabad districts and participated in the seminar on 'Integrated pest management' on 15th and 16th September 2003 respectively.
- Dr. R.G. Somkuwar and Dr. A.K. Upadhyay visited Nasik on 25th July and Dr. S.D. Sawant, Dr. S.D. Ramteke and Dr. Jagdev Sharma visited Sangli and Nasik on 19th and 23rd September respectively under SBI's Project Uptech.
- Dr. R.G. Somkuwar visited vineyards in Solapur and Latur region on 9th November and again on 9-10th December 2003 to study the canopy management practices followed by the growers after October pruning and advised them on proper canopy management, nutrition and irrigation for improving their yield.
- Dr. R.G. Somkuwar visited vineyards in Sangli on 24th November 2003 to assess the problem of reduced bud differentiation after October pruning in this area.

- Dr. R.G. Somkuwar and Dr. S.D. Ramteke visited Tasgaon under SBI Project Uptech - Grapes on 26th November 2003.
- Dr. Jagdev Sharma visited vineyards at Savlaj, district Sangli on 24th January 2004 and demonstrated the utility of different soil moisture conservation practices like mulching and subsurface irrigation to the growers of Baramati.
- Dr. P.G. Adsule visited Manchar in Pune district on 25th January 2004 to deliver a talk on 'Grape marketing' to the grape growers. He also visited M/s Abhinav Grape Growers' Cooperative Society, Junnar to know their problems in respect of grapes and advise them accordingly.
- Dr. R.G. Somkuwar and Dr. Jagdev Sharma visited vineyards at Dindori, district Nasik on 27th January 2004 under SBI Project Uptech.
- Dr. R.G. Somkuwar, Dr. S.D. Ramteke and Dr. N.S. Kulkarni visited Ranga Reddy district and Medchal Mandal in Andhra Pradesh on 24-25th February 2004 to survey vineyards for pre-harvest practices for the production of export quality grapes.

Participation in Growers' Seminar

- Dr. P.G. Adsule, Director and scientists Dr. S.D. Sawant, Dr. R.G. Somkuwar and Dr. Jagdev Sharma participated in growers' seminars at Sangli, Solapur, Nasik and Baramati during 24th - 30th April 2003 and delivered presentations on various areas of viticulture after April pruning.
- Dr. P.G. Adsule, Director chaired the technical session of the seminar organized by APEDA on 27th May 2003 and delivered presentation on berry scarring and pesticide residue problem in grapes. Dr. Karibasappa presented information on newer table grape varieties for export and their cultural practices. Dr. S.D. Sawant and Dr. Jagdev Sharma delivered presentations on strategies for efficient use of fungicides during the foundation-pruning period and efficient water and nutrient management respectively.
- All the scientists participated in the Annual Seminar of Maharashtra State Grape Growers' Association held at Pune on 23-24th August. More than 2000 grape growers attended the seminar. Scientists delivered lectures on various aspects of viticulture viz. grape varieties (Dr. G.S. Karibasappa), canopy management (Dr. R.G. Somkuwar), Use of bioregulators (Dr. S.D. Ramteke), water and nutrient management (Dr. Jagdev Sharma), disease management (Dr. S.D. Sawant), Use of micro-organisms in Grapes (Dr. Indu S. Sawant) and Internet use (Mrs. Kavita Mundankar). Besides lectures, technical guidance was also given to growers through one to one interaction.
- Dr. P.G. Adsule visited the horticulture farm of State Department of Andhra Pradesh at Vikarabad to review the progress of APEDA project on 'Introduction, evaluation and distribution of grape planting material suitable for export on 24th November 2003. He also visited few vineyards in Ranga Reddy district to see the crop and problem faced by the growers.

- Dr. S.D. Sawant, Dr. R.G. Somkuwar and Dr. N.S. Kulkarni visited vineyards of Ranga Reddy district of Andhra Pradesh during 23- 24th December 2003 at the request of the Assistant Director of Horticulture, Govt. of Andhra Pradesh to survey the vineyards for problems related to water shortage, nutrition, canopy and pests and advised the farmers through interactive discussions and lectures.
- Dr. G.S. Karibasappa visited NARI, Phaltan on 6th December 2003 to assess the progress of APEDA sponsored project on export quality grape varietal trial.
- Dr. P.G. Adsule, Dr. S.D. Sawant, Dr. R.G. Somkuwar, Dr. S.D. Ramteke and Dr. Jagdev Sharma visited vineyards in Narayangaon and Junnar and attended a technical meeting on 19th November 2003 called by Abhinav Grape Growers' Cooperative Society Ltd., Agar, Dist. Pune.
- Dr. Jagdev Sharma attended technical meeting of grape growers at Junnar on 13th March 2004 and demonstrated different methods of water conservation.
- Dr. G.S. Karibasappa participated in a discussion at Champagne India Ltd., Narayangaon on 22nd March 2004.

In house discussions

- Approximately 400 farmers visited the Centre during this year to seek solutions to their problems. They discussed their problems with the concerned scientist.

Other

- Dr. Indu S. Sawant popularized the use of bio-control agents among grape growers through direct interaction or through lectures or popular articles. The grape growers and producers of bio-control agents were advised / educated about the various precautions to be taken to make bio-control a viable option.

Participation in exhibition

The Centre participated in "Bio-Expo" organised at Vidya Pratishthan's School of Biotechnology, Baramati on 3rd march 2004. Several Exhibits illustrating achievements and technologies developed at the Centre were displayed. The stall received enormous response from representatives of several scientific and commercial organisation, farmers, school children and housewives for wine and raisin varieties.

Training Acquired

Sl. No.	Name	Training Title	Period	Organized by
A. Deputation abroad				
1.	Dr S. D. Sawant and Dr A K Upadhyay	Pesticide residue analysis	26th - 31st January 2004	TNO lab, Zeist, Netherlands
B. Trainings in India				
I. Scientific staff				
2.	Dr. S.D. Ramteke	Application of Stable Isotopes to Study Physiological Processes for Crop Improvement	2nd –23rd December 2003	Department of Biotechnology at University of Agricultural Sciences, Bangalore
III. Administrative Staff				
3.	Sh. B.N. Ramchandrapp-a and Mrs. Anita Mathew	Computer Applications for Administrative and Financial Management	16-23rd September 2003	NAARM, Hyderabad
4.	Sh. A. Srinivasamurthy	New Formats of Accounts prescribed by the CGA for Central Autonomous Bodies (Non-profit Organizations) for the Finance & Accounts Officers of ICAR	13-17th October 2003	National Institute of Financial Management, Faridabad

Training Given

1. Training on Development of Integrated Pest Management (IPM) in Grapes

To tackle the problem of pesticide residues in table grapes, a four day training programme on IPM was developed for grape growers, technical officers of grape exporting houses, development officers of pesticide companies and officers of horticulture department. Sixty-three participants, in two batches (2-5th September 2003 and 29th September - 1st October 2003), were given practical information on various principles and techniques in plant protection followed by a brain storming session wherein each participant developed his own IPM strategy best suited for his agro-climatic conditions.

2. Training on Advances in Tropical Viticulture

The Centre organized a training programme on 'Advances in Tropical Viticulture' during 25-27th September 2003 for the officials of M/s Mahindra Subh Labh Services Ltd., who offer contract services to grape growers in Maharashtra.

3. Short term training

- Dr. Indu S. Sawant conducted six months project training entitled 'Isolation, characterization and evaluation of salt tolerant Phosphate solubilizing micro-organisms from vineyard soils' for two M.Sc. students from Modern College, Pune.
- Dr. Indu S. Sawant imparted Four month training on various aspects of bio-control and bioremediation with *Trichoderma.* to three M.Sc. students from Environmental Science Department of VSI, Pune.
- Dr. Indu S. Sawant imparted one month training on 'Effect of the soil application of the insecticide 'Actara' on soil micro-organisms' to two B.Sc. students from Bio-technology Department, Fergusson College, Pune.
- Dr. Anuradha Upadhyay conducted summer training on 'DNA analysis in Grapes' for the students of Abeda Inamdar Junior College, Pune and College of Biotechnology, Baramati during 21st May – 22nd June and 11th May – 19th July 2003 respectively.
- Dr. S.D. Ramteke conducted 6 weeks summer training for M.Sc. students of Pune University during 1st – 15th July 2003.

4. Others

- Scientists of the Centre were resource persons for the training programme on Viticulture organized by Maharashtra State Grape Growers' Association during 14th July to 7th August and 27th August to 20th September 2003. They delivered lectures in their field of specialization and gave technical guidance through interaction and during field visits.
- Dr. P.G. Adsule and Dr. R.G. Somkuwar delivered lectures on 'Grape Industry in India' and 'Economics of grape cultivation in India' respectively in the training programme entitled 'Development of fruits and vegetables processing and marketing through cooperative' conducted by Vaikunth Mehta National Institute of Cooperative Management, Pune during 6-12th January 2004.
- Dr. R.G. Somkuwar delivered lectures on 'Physiology of grape berry development' and 'Factors affecting fruitfulness in grapes' on 5th March 2004 to the trainees of 'National training programme on growth and development of fruit crops' organized by the Centre for Advanced Studies in Horticulture (Fruits), M.P.K.V., Rahuri.

- Dr. Jagdev Sharma received 'Abhinav Gaurav 2003' award for contribution towards grape growing and providing technical knowledge for the production of export quality grapes to the growers members of Abhinav Grape Growers' Society (Regd.), Junnar, Pune.

  On this occasion, Dr. P.G. Adsule, Director, Dr. S.D. Sawant and Dr. R.G. Somkuwar were also felicitated for their contributions in viticulture.

- Centre under the guidance of Headquarter officials conducted All India Combined Entrance Examination for Admission to Master's Degree Programme and Award of JRF for the academic session 2003-04, held on 15th June 2003 at Kendriya Vidyalaya, Ganesh Khind, Pune. Dr. G.S. Karibasappa, Sr. Scientist was associated with this work from the Centre.

- Dr. Anuradha Upadhyay was nominated as member of Panel of Examiners of B.Sc. (Biotechnology) course of Vidya Pratishthan School of Biotechnology, Baramati, Pune.

A. Collaborative Projects

Sl. No.	Title	Source of Funding	Collaborating Centres
1.	Induction of Downy Mildew Resistance in Commercial Cultivars of Grapes through Cross Breeding and in-vitro Embryo Rescue Methods	NATP	NCL, Pune ARI, Pune
2.	Introduction, Evaluation, Multiplication and Supply of Grape Varieties Suitable for Export	APEDA	State Deptt. of Hort./ SAU of T.N. / A.P. / M.S. / Karnataka
3.	Survey and Surveillance in Western India for Infestation of Grapes and Mangoes by Oriental Fruit Fly	APEDA	M.P.K.V., Rahuri, K.K.V., Dapoli, M.A.U., Parbhani, P.D.K.V., Akola, G.A.U., Ahmedabad
4.	Micro-propagation of Selected Grape Varieties and Rootstocks and DNA Finger Printing of Grape Germplasm	DBT	NCL, Pune ARI, Pune
5.	Pesticide Residue Monitoring Plan in Fresh Grapes for Export	APEDA	APEDA, State Govts, Nominated laboratories for pesticide analysis

B. Externally Funded Projects

Sl. No.	Title	Source of Funding
1.	Collection and Augmentation of Grape Germplasm under multi institutional project on Plant Bio-diversity.	NATP
2.	Molecular Tagging of Downy Mildew Resistance in Grapes	DBT

PUBLICATIONS

Research Articles

1. Bharathy, P.V.; Karibasappa, G.S.; Biradar, A.B.; Kulkarni, D.D.; Solanke, A.U.; Patil, S.G. and Agrawal, D.C. 2003. Influence of pre-bloom sprays of benzyladenine on *in-vitro* recovery of hybrid embryos from crosses of Thompson Seedless and 8 seeded varieties of grapes (*Vitis spp.* L.). *Vitis* **42(4)**: 199-202.
2. Ramteke, S.D., Satisha, J., Singh, R.K. and Somkuwar, R.G. 2001. Effect of soil moisture stress on nutrient content, growth and yield of Tas-A-Ganesh grapes grafted on Dogridge rootstock. *Annals of Plant Physiology.* **15(1)**:67-71.
3. Ramteke, S.D.; Sharma, Jagdev; Singh, R.K. and Somkuwar, R.G. 2001. Effect of soil moisture stress on nutrient content, growth and yield of Tas-A-Ganesh grapes grafted on Dogridge rootstock. *Ann. Plant. Physiol.* **15(1):** 67-71.
4. Ramteke, S.D.; Somkuwar, R.G.; Shikhamany, S.D. and Banerjee, K. 2003. Cumulative effect of hydrogen cyanamide on growth, yield and quality of Tas-A-Ganesh grapes. *Ann. Plant. Physiol.* **17(1):** 6-11.
5. Sawant, S.D., Sawant, Indu S. and Banerjee, Kaushik. 2003. Minimizing sulphur dioxide injury in table grapes (*Vitis vinifera*) for export by pre-harvest benomyl sprays. *Indian Journal of Agricultural Sciences.* pp. **72** : 635-638.
6. Sharma, Jagdev and Upadhyay, A.K. 2003. Effect of moisture stress on performance of own rooted and grafted vines of Tas-A-Ganesh (*Vitis vinifera* L.). Oral paper presented in *7th International Symposium on Temperate zone Fruits in the Tropics and Subtropics during 14-18th October 2003* organized by Dr. Y.S. Parmar University of Horticulture and Forestry and International Society for Horticultural Science at Solan, Himachal Pradesh. Pp. 116.
7. Sharma, Jagdev, Shikhamany, S.D. and Singh, R.K. 2003. Studies on bunch stem necrosis disorder in grape in Maharashtra. 2003. *Indian J. Hort.* **60(2)** : 154-157.

Popular Articles

1. Adsule, P.G. 2003. WTO and its relevance to the grape trade (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 29-30.
2. Adsule, P.G., Dagade, S.B., Karad, S.R. and Karibasappa, G.S. 2003. Raisin production from grapes (in Marathi). *Shetkri* **3(10)** : 39-42.
3. Adsule, P.G., Karibasappa, G.S., Karad, S.R. and Dagade, S.B. 2003. Grape wine varieties and their features (in Marathi). *Shetkri* **30(10)** : 43-44.
4. Dagade, S.B. and Karibasappa, G.S. 2004. Red Globe : an export quality grape variety. *Phalbagh Vritta* **9(7)**: 18.
5. Karibasappa, G.S. and Dagade, S.B. 2003. A useful variety for grape processing (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 157.

6. Karibasappa, G.S. and Dagade, S.B. 2003. Important white and red grape varieties for wine making (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 20-23.

7. Karibasappa, G.S. and Dagade, S.B. 2003. Superior Seedless and Red Globe : High yielding, quality, table grape varieties (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 18-19.

8. Karibasappa, G.S. and Dagade, S.B. 2003. Useful seeded table grape varieties. *Drakshavritta* Souvenir August 2003. pp. 155-156.

9. Karibasappa, G.S. and Wakhare, A.R. 2004. Some promising new grape varieties for table, raisin, juice and wine making. *Krishi Vyasapeeth* **1** : 21-25.

10. Karibasappa, G.S., Dagade, S.B. and Reddy, Suvarna. 2003. Importance of disease free planting material and improved method of vine selections in grapes (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 16-17.

11. Karibasappa, G.S.; Dagade, S.B. and Suvarna Reddy. 2004. Production of improved, disease free planting material and importance of clonal selection in grape cultivation. *Phalbagh Vritta* **9(9)** : 27-28.

12. Mundankar, Kavita. 2003. Internet for agricultural information (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 163-168.

13. Ramteke, S.D. 2003. Growth regulators - Preparing solutions and its use. (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 95-98.

14. Ramteke, S.D. 2003. Management of growth regulators after October pruning in grape vineyard (in Marathi). *Phalbagvritta*, October 2003. pp. 29-31.

15. Ramteke, S.D. 2003. Production of export quality grapes – Part I (in Marathi). *Kesari (Daily newspaper).* 17th November 2003. pp. 10.

16. Ramteke, S.D. 2003. Production of export quality grapes – Part II (in Marathi). *Kesari (Daily newspaper).* 24th November 2003. pp. 10.

17. Ramteke, S.D. 2003. Use of growth regulators for production of quality grapes (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 91-94.

18. Ramteke, S.D. 2003. Weeds in grape vineyards and their control (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 102-103.

19. Sawant, Indu S. and Sawant, S.D. 2003. Relevance of biological control in integrated pest management (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 85-88.

20. Sawant, S.D. and Sawant, Indu S. 2003. Appropriate use of pesticides for plant protection in grape. (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 61-66.

21. Sharma, Jagdev and Kadu, Rohit. 2003. Answers to some queries raised by grape growers (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 51-52.

22. Sharma, Jagdev and Kadu, Rohit. 2003. Nutrient management of vineyards by spraying (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 49-50.

23. Somkuwar R.G. 2004. Canopy management in relation to shortage of irrigation. *Drakshavritta* - March 2004. pp.

24. Somkuwar, R.G. 2003. After foundation pruning – in short (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 15.

25. Somkuwar, R.G. 2003. Develop pure grape rootstocks by mass multiplication method. *ICAR News*, A Sci. & Tech. Newsletter. July - Sept. **9(3)**:15.

26. Somkuwar, R.G. 2003. Sub-cane development after April pruning. *Drakshavritta.* April 2003. pp. 7-8.

27. Somkuwar, R.G. 2003. What to do after October pruning (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 14.

28. Somkuwar, R.G. and Satisha, J. 2003. Importance of planting grape vineyards on rootstock (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 11-13.

29. Somkuwar, R.G. and Satisha, J. 2003. Important considerations for new grapevine establishment (in Marathi). *Drakshavritta* Souvenir August 2003. pp. 158-159.

8. Somkuwar, R.G. 2003. Use of rootstocks for grape production. *ICAR News, A science and technology Newsletter,* New Delhi. **9(1)** : 1-2.

Technical Bulletin

1. Sharma, Jagdev. 2003. Fertigation in grapes. (Eds). Adsule, P.G. and Upadhyay, Anuradha. Technical bulletin No. 4, National Research Centre for Grapes, Pune, pp. 18.

Video CD

1. Grapes for Export (English / Hindi / Marathi)

Institute Publications

1. Grapes for Health. National Research Centre for Grapes, Pune, India.

2. Adsule, P.G., Sawant, Indu S., and Upadhyay, Anuradha. 2004. Year Planner. National Research Centre for Grapes, Pune, India.

3. Adsule, P.G., Upadhyay, Anuradha and Sawant, Indu S. 2003. Annual Report 2002-03, National Research Centre for Grapes, Pune, India. Pp. 56.

APPROVED ON-GOING PROJECTS

1. Management of Genetic Resources of Grapes.
   G.S. Karibasappa, J. Satisha (On SL), P.G. Adsule, S.D. Sawant, S.D. Ramteke

2. Grape Germplasm Information System.
   Kavita Y. Mundankar and G.S. Karibasappa

3. Molecular Tagging of Downy Mildew Resistance in Grapes.
   Anuradha Upadhyay, G.S. Karibasappa and Indu S. Sawant

4. Evaluation of Grape Rootstocks for Salinity and Drought Tolerance.
   R.G. Somkuwar, J. Satisha (on SL), Jagdev Sharma and S.D. Ramteke

5. Standardization of Canopy Architecture to Maximize the Production of Export Quality Grapes.
   R.G. Somkuwar, S.D. Ramteke and S. D. Sawant

6. Developing the Petiole Nutrient Guides for Grapes Raised on Rootstocks.
   Jagdev Sharma, S.D. Shikhamany, R.K. Singh and Ajay K. Upadhyay

7. Improving Nutrient Use Efficiency in Grapes.
   Jagdev Sharma, R.K. Singh, Ajay K. Upadhyay and Indu S. Sawant

8. Use of Bio-Regulators to Increase the Productivity and Export Quality of Grapes from Grafted Vines.
   S.D. Ramteke, J. Satisha (on SL) and R.G. Somkuwar

9. Improving Fungicide Use Efficiency in Grapes.
   S.D. Sawant, Indu S. Sawant and Kaushik Banerjee

10. Management of Newly Emerging Grape Diseases of Economic Importance.
    Indu S. Sawant and S.D. Sawant

11. Management of Post-harvest Decay in Grapes for Export.
    Indu S. Sawant, S.D. Sawant and Kaushik Banerjee

12. Integrated Management of Insect Pests on Grapes.
    N.S. Kulkarni, Indu S. Sawant, S.D. Sawant and G.S. Karibasappa

13. Monitoring of Agrochemical Residues in Grapes.
    Kaushik Banerjee

MEETINGS OF QRT, RAC, IMC & SRC

Quinquennial Review Team Meeting

The final Quinquennial Review Team meeting of the Centre was held at ICAR Head Quarters at New Delhi on 30th April – 1st May 2003 under the chairmanship of D.D.G. (Hort.). Dr. P.G. Adsule, Director and Dr. Indu S. Sawant, Member Secretary convened the meeting.

Research Advisory Committee Meeting

Following were the members of reasearch Advisory Committe.

Dr. B.S. Chundawat	:	Ex. V.C., Gujarat Agricultural University - *Chairman*
Dr. G. Satyanarayana	:	Prof. & Head (Retd.) Hort, A.P.A.U., Hyderabad - *Member*
Dr. Raghbir Singh	:	Prof. (Hort.), P.A.U., Ludhiana - *Member*
Dr. B.R.V. Iyangar	:	Head, Soil Science (Retd.), I.I.H.R., Bangalore - *Member*
Dr. K.V. Krishnamurthy	:	Head, Plant Tissue Culture Div., NCL, Pune - *Member*
Dr. M. Uday Kumar	:	Prof. & Head, Dept. of Crop Science, U.A.S., Bangalore - *Member*
Dr. R.D. Rawal	:	Head, Div. of Pl. Pathology, I.I.H.R., Bangalore - *Member*
Dr. P.G. Adsule	:	Director, NRC for Grapes, Pune
Dr. S.N. Pandey	:	A.D.G. (Hort.), ICAR, New Delhi - *Member*
Sh. Mahipal Singh Nain	:	Grape Grower, Bhagpat, U.P. - *Member*
Dr. Indu S. Sawant	:	Sr. Scientist, NRC Grapes, Pune - *Member Secretary*

The 6th Research Advisory Committee meeting of the Centre was held on 3-4th March 2004 at NRC for Grapes, Manjri, Pune. The meeting was chaired by Dr. B.S. Chundawat, Ex. Vice-chancellor, Gujarat Agricultural University. The Committee interacted with the scientists, reviewed the progress of work and visited nearby export house and winery and interacted with the office bearers of these enterprises. The Committee expressed satisfaction from the feedback received from both these enterprises on the role of NRC for Grapes in addressing their problems.

Committee emphasized that in the fast changing agricultural scenario, new problems and challenges are emerging and the Centre has to redefine its goals to make Indian viticulture more competitive in the domestic as well as in the world market. The committee suggested addressing the need to increase the area under grape cultivation by appropriate land use planning, improved disease and pest management, production of good quality organic grapes and resolving the problems faced by growers from the newer non-traditional areas.

Institute Management Committee Meeting

Following are the members of Institute Management Committee

Dr. P.G. Adsule	- Director, NRC Grapes, Pune - *Chairman*
Dr. G.S. Karibasappa	- Sr. Scientist, NRC Grapes, Pune - *Member*
Dr. Indu S. Sawant	- Sr. Scientist, NRC Grapes, Pune - *Member*
Dr. R.G. Somkuwar	- Sr. Scientist, NRC Grapes, Pune - *Member*
Dr. Kaushik Banerjee	- Scientist Sr. Scale, NRC Grapes, Pune - *Member*
Dr. S.N. Pandey	- ADG (Hort.), ICAR, New Delhi - *Member*
Shri. Mahipal Singh Nain	- Grape Grower, Bhagpat, UP., *Member*
Shri. A. Srinivasamurthy	- AAO (I/c)NRC Grapes, Pune - *Member Secretary*

The IMC met twice during the year. The 14th meeting of IMC was held on 12th September, 2003. The committee reviewed the progress of developmental projects goig on at the Centre and re-apprpriation of funds.

The 15th meeting was held on 16th March 2004 under the Chairmanship of Dr. P.G. Adsule, Director. The Committee discussed and approved the issues related to condemnation of old vehicle, construction of National Referral Laboratory building, purchase of equipments and collaborative research and training with M/s Champagne India Ltd., Narayangaon and M/s Grape Processing and Research Institute, Palus.

Staff Research Council Meeting

The 8th SRC meeting of the Centre was held during 28th June - 2nd July 2003, to review project-wise progress of the research work, the technical programmes for 2003-04 and decide the new project proposals in light of interactions with grape growers on new emerging problems and the last RAC and QRT recommendations.

The mid-term SRC was held on 12th October, 2003. The progress of the projects during six months was reviwed and modifications in technical programme, if any, was discussed and approved.

Consultancy Project

A. SBI Project Uptech : Increasing production and productivity of grapes in Western Maharashtra

(P.G. Adsule, R.G. Somkuwar, S.D. Sawant, A.K. Upadhyay, S.D. Ramteke, J. Sharma and N.S. Kulkarni)

The Programme was implemented at three grapes growing Centres selected for the purpose within Nasik, Sangli and Solapur districts *viz.* Pimpalgaon, Tasgaon and Pandharpur respectively.

The bank and the Centre jointly chose grape growers who require improvement in production technology. The growers were given on farm practical training to adopt the improved production technology by the scientists of the Centre. At each important stage of crop growth i.e. from April pruning to harvesting of crop, Scientists of the centre visited the vineyards and monitored the execution of production technology by the growers. The growers were given all required guidance for execution of technology. Impact of the programme will be assessed by observing the productivity in terms of quality and quantity of grapes produced at the closure of project.

Field visits were undertaken as per the growth stages in three different regions (Nasik, Solapur and Sangli). During the visits, following problems were noticed and suggestions were given to rectify the problems.

Problems noticed	Suggestions given
Shortage of water	The growers were advised to maintain the appropriate number of shoots per vine based on the availability of the irrigation water. Use of rootstock for the establishment of new vineyard was also brought to their notice. The growers were advised to make only straight canes.
Incidence of diseases	This was mainly due to the congenial condition developed in overcrowded canopy. Removal of excess shoots from individual vines to avoid build up of microclimate congenial to disease emergence/ spread in the canopy was suggested to the growers of the region.
Reduced fruitfulness	Reduction in the fruitfulness was mainly due to shortage of irrigation water. Since there was not enough irrigation water available to irrigate the vineyard, fertilizers like Phosphorus required for the fruit bud differentiation was not applied, resulting in reduced fruitfulness.
More bunch load	To avoid mummification and reduction in the quality, the growers were advised to retain the bunches as per the spacing available per vine.
Delay in pruning	The growers were advised to prune the vineyard before initiation of new growth to avoid the wastage of reserve food material from the developed canes.

B. Introduction, Evaluation and Distribution of Planting Material of Grape Varieties Suitable for Export Purposes (APEDA funded project)

(P.G. Adsule, G.S. Karibasappa, S.D. Sawant, R.G. Somkuwar and J. Sharma)

This project is undertaken to popularize the export quality table grape varieties. Under this programme three varieties *viz.* Red Globe, Crimson Seedless and Italia have been introduced from California, USA. Eight Centres have been identified with NRC for Grape, Pune acting as the nodal Centre for testing these varieties. The coordinating Centre are: (i) Nimbkar Agricultural Research Institute (NARI), Phaltan, district Satara; (ii) Sh. Rajendra Sonawane, Khedgaon, Dindori, district Nasik; (iii) Sh. Mirza Jaffer Hussain, Theni, Tamil Nadu; (iv) Indian Institute of Horticultural Research, Bangalore; (v) Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu; (vi) Horticultural Farm, Vikarabad, Rangareddy district, Andhra Pradesh and (vii) Horticultural Farm, Chigicherla, Ananthapur, Andhra Pradesh

Red Globe

During the year, the Centres at Phaltan, Khedgaon, Theni, Bangalore and NRC for Grapes established grafted vineyards of one acre each. Other Centres have established rootstock plants which will be ready for grafting during October 2004.

Italia

Crimson Seedless

C. Other Consultancy programmes

Technical guidance on biological control of grape diseases was given by Dr. Indu S. Sawant to Mahagrapes, Pune during a programme arranged for grape growers of Walwa, Dist Sangli, Maharashtra.

PARTICIPATION IN CONFERENCES, MEETINGS, WORKSHOPS, ETC.

- Dr. P.G. Adsule, Dr. G.S. Karibasappa and Dr. Anuradha Upadhyay participated in the 'Biotech Summit 2003' organized by the Indo-American Chamber of Commerce held at Pune on 16-17th May 2003.
- Dr. A.K. Upadhyay participated in national seminar on 'Integrated nutrient management of plantation crops' organized by the Indian Society of Plantation Crops at Central Plantation Crop Research Institute, Kasaragod on 14th August 2003.
- Dr. P.G. Adsule, Dr. G.S. Karibasappa and Dr. Anuradha Upadhyay participated in 'International seminar on sugarcane genomics and genetic transformation' organized by Vasantdada Sugar Institute, Pune on 28-29th August 2003.
- Dr. Anuradha Upadhyay participated and presented a project proposal in discussion meeting on 'Molecular breeding' convened by Dy. Director General (Hort.), ICAR at NRC for DNA Fingerprinting, New Delhi on 4th September 2003.
- Dr. S. D. Sawant, participated in the 6th International Workshop on Plant Growth Promoting *Rhizobacteria* organized by the Indian Institute of Spices Research, Calicut from 5-10th October 2003.
- Dr. Indu S. Sawant delivered a lecture on 'Patenting in Agricultural Technologies' and interacted with the participants on various issues in the national seminar on 'Intellectual Property Rights and Agricultural Technology : Emerging Issues and Challenges' organized by Shivaji University, Kolhapur, Maharashtra on 13 - 14th October 2003.
- Dr. Jagdev Sharma, Scientist Sr. Scale (Soil Science) participated in the '7th International Symposium on Temperate Zone Fruits in the Tropics and Subtropics' organized by the University of Horticulture & Forestry, Solan on 14 -18th October 2003.
- Dr. Anuradha Upadhyay participated in a workshop on 'Agriculture Bioinformatics' at Indian Institute of Spices Research, Calicut on 29-30th November 2003 and delivered a lecture on 'Bioinformatics in Genomics'.
- Dr. P.G. Adsule, Director participated in the meetings convened by the APEDA at Bangalore and Hyderabad on 9th January and 20th January 2004 respectively to discuss the issues related to regulation of export of fresh grapes from India through monitoring of pesticide residues and presented monitoring plans to the Horticultural Officers, grape growers and exporters of respective states.
- Dr. P.G. Adsule, Director participated in the seminar on 'Agri Advantage 2004' as a Special Invitee organized by CII, at Nasik on 17th February 2004 and presented a paper on 'Recent advances in grapes'.
- Dr. P.G. Adsule participated in the meeting convened by the APEDA at Nasik on 7th March 2004 regarding pesticide residue problems in export consignment.
- Dr. P.G. Adsule participated in the 'National Conference on Organic Farming for Sustainable Production' organized by the Horticulture

Society of India in collaboration with the ICAR and CISH at NASC Complex, New Delhi on 23-25th March 2004 as an invited delegate.

- Dr. S.D. Ramteke participated in the National seminar on 'Assessment, Utilization and Conservation of Biodiversity' at Department of Botany, University of Pune on 26th March 2004. He delivered a lecture on 'Evaluation of grape rootstocks for drought tolerance'.
- Dr. Indu S. Sawant Member attended and participated in the meetings of IMC of the NRC for Onion and Garlic, Rajgurunagar.

Secretary, DARE and Director General, ICAR Visits the Centre

Dr. Mangala Rai, Secretary, DARE and Director General, ICAR visited the Centre on 10th June 2003 and interacted with all the staff members. He also inaugurated a polyhouse constructed under the DBT sponsored project on this occasion

Secretary, DARE, and DG, ICAR highlighted the changing scenario in agriculture in general and grape industry in particular vis-a-vis the WTO and global liberalization in his address and called upon the scientists to work with a futuristic approach to develop varieties and technologies for wine, as this sector is receiving lot of attention at the global level. In the beginning, Dr. P.G. Adsule, Director briefed the Secretary, DARE and DG, ICAR about the ongoing research works and progress of the Centre.

EU team's visit to the Centre

A three member European Union Commission team visited the Centre on 20th February 2004 to monitor the progress of National Referral Laboratory scheme under the pesticide residue monitoring plan of the APEDA. They were accompanied by Mr. S. Dave, Director, APEDA and Mr. R.P. Gautam, General Manager, Mumbai (APEDA) office. Dr. P.G. Adsule briefed the team about the pesticide residue monitoring plan to be followed in the country for exportable grapes.

Other visitors

- Dr. N.H. Hegde, President, Bharatiya Agro Industries Foundation (BAIF) visited the Centre on 24th July 2003.
- Dr. M.G. Lande, Director (Research & Education), Maharashtra Council of Agricultural Education and Research, Pune visited the Centre on

27th August 2003 and discussed about wine grape processing etc. with Dr. P.G. Adsule, Director.

- Dr. Y.S. Nerkar, Director (Research & Extension), Vasantdata Sugar Institute, Pune visited the Centre on 2nd September 2003.
- Sh. Sopan Kanchan, President, Grape Growers' Federation of India and Chairman, Confederation of Indian Horticulture visited the Centre on 5th September 2003.
- Dr. M.G. Lande, Director (Research and Education), Maharashtra Council of Agricultural Education and Research, Pune visited the Centre on 27th October 2003.
- Dr. V.S. Rao, Director, Agharkar Research Institute, Pune visited the Centre on 28th November 2003.
- Dr. D.L. Sale, Associate Dean, College of Agriculture, Pune visited the Centre on 28th November 2003.
- Dr. B.S. Dhankar, Professor of Vegetable Science, CCS, HAU, Hissar visited the Centre on 30th November 2003.
- Dr. D.S. Khurdiya, Ex-Head, Division of Post-harvest Technology, Indian Agriculture Research Institute, New Delhi visited the Centre on 30th November 2003.
- Dr. S.L. Mehta, Director, NATP and Sh. H.C. Pathak, Director (Finance) visited the Centre with regard to functioning of NATP programmes at the Centre on 21st February 2004.
- A batch of 30 management students from International Institute of International Agri-Business management, Pune visited the Centre on 25th February 2004 to acquaint with grape crop, status and marketing in India and abroad.

	Name of the official	Designation
	Dr. P.G. Adsule	Director and Principal Scientist, Hort. (PHT)
Scientific	Dr. G.S. Karibasappa	Senior Scientist, *Hort.*
	Dr. Indu. S. Sawant	Senior Scientist, *Plant Path.*
	Dr. S.D. Sawant	Senior Scientist, *Plant Path.*
	Dr. R.G. Somkuwar	Senior Scientist, *Hort.*
	Dr. Anuradha Upadhyay	Senior Scientist, *Biotech*.
	Dr. Ajay Kumar Upadhyay	Senior Scientist, *Soil Science*
	Dr. Kaushik Banerjee	Scientist Sr. Scale, *Agric. Chem.*
	Dr. S.D. Ramteke	Scientist Sr. Scale, *Plant Physiol.*
	Dr. Jagdev Sharma	Scientist Sr. Scale, *Soil Science*
	Mr. J. Satisha	Scientist, *Hort.* (On study leave)
	Ms. Kavita Y. Mundankar	Scientist, *Computer Appl.*
	Dr. N.S. Kulkarni	Scientist, *Entomology (w.e.f. 25.08.2003)*
Technical	Mr. U.N. Borse	T-3 *(Agri. Engg.)*
	Mr. P.B. Taware	T-3 *(Farm Technician)*
	Mr. P.B. Jadhav	T-2 (Driver)
	Mr. S.S. Bhoite	T-2 (Field Assistant)
	Mr. B.B. Khade	T-2 (Laboratory Technician)
	Ms. Shailaja.V. Satam	T-2 (Computer Operator)
	Mr. E.G. Kamble	T-1 (Field Assistant)
	Mr. B.J. Phalke	T-1 (Laboratory Technician)
Administrative		Mr. A. Srinivasamurthy AF & AO
	Mr. O. Babu	Assistant
	Mr. L.R. Gopalakrishnan	Assistant
	Mr. B.M. Chavan	Personal Assistant
	Mr. B.N. Ramchandrappa	Sr. Clerk (*till*
	Mr. K. Ali	Sr. Clerk
	Mr. N.S. Pathan	Jr. Clerk
	Ms. Anita Mathew	Jr. Clerk
Supporting	Mr. S.S. Donde	SSG-II (Messenger)
	Mr. K.G. Raskar	SSG-I (Messenger)
	Mr. B.R. Chakankar	SSG-I (Mali)
	Mr. S.V. Lendhe	SSG-I (Mali)
	Ms. Lata Pawar	SSG-I (Mali)
	Mr. V.D. Gaikwad	SSG-I (Messenger)
	Mr. N.K. Najan	SSG-I (Messenger)

INFRASTRUCTURE DEVELOPMENT

The infrastructure at the Centre was strengthened with the addition of several sophisticated equipments like PCR machine, Multichannel Auto Analyser, Canopy Analyser, Infra-red Gas Analyser, Automatic Weather Station, Solid Phase Extractor, Multimedia Projector besides many basic equipments.

Infra red gas analyser

The information technology also received impetus with the establishment of Local Area Network (LAN) which connects all the available computers at the Centre and one CDM Server to facilitate the access of database CDs among multiple users. These facilities have greatly helped in better sharing of data, information and resources.

Irrigation facilities at the Centre were further extended by laying down approximately 3000 feet pipeline from the adjacent lift irrigation system belonging to the Dairy Farm of College of Agriculture, Pune.

OTHER ACTIVITIES

Scientist - Farmer Interface Meeting

During the field visits of scientists of the Centre, berry scarring was noticed in matured grape bunches in the entire grape growing regions of Maharashtra, Karnataka and Andhra Pradesh. At the suggestion of the leading grape growers' societies and associations, a deliberation was organized at this Centre on 31st May 2003 by inviting all the grape growers. In the programme, the experiences of grape growers were shared in occurrence of berry scarring. By and large, the pruning time (date), variations in climate (temperature, humidity and frost) during the growth period, use of various chemicals to control diseases and pests were the factors related to this malady. Accordingly, the research programme / action has been planned and initiated to pin point the causes and the measures to overcome this problem.

Indiscriminate use of pesticides in grape has created problem of pesticide residues beyond the MRL, besides use of non-registered chemicals with the CIB to control various diseases and pests. The problem was seized and meeting was convened on the same day in the afternoon to analyse the situations leading to pesticide residues with grape growers. For this programme, some of the self-proclaimed organic grape growers from Sangli, Solapur and Nasik were also invited and were requested to present the organic practices followed by them for grape cultivation. Major inputs involved in the organic grape production were green manuring, use of cow dung / urine slurry and plant extracts for nutrients and to control the

diseases and insect pests. Scientists of the Centre analysed the situation of pesticide residue and organic mean of grape cultivation to find out the middle path or the judicious level of chemicals for the control of diseases and pests.

Independence Day

The Independence Day was celebrated at the Centre on 15th August. Dr. P.G. Adsule, Director hoisted the flag. In his address he emphasized the role of farmers and agriculture towards progress of the nation. He called upon the staff to work hard for upliftment of the farmers by developing improved technologies. Children of the staff sang patriotic songs and sweets were distributed.

Hindi Pakhwada

हर वर्ष की तरह इस वर्ष भी केन्द्र में हिन्दी पखवाड़ा १५ सितंबर से ३० सितंबर तक निदेशक डा. पी. जी. अडसुले, की अध्यक्षता में मनाया गया। पखवाड़े का शुभारंभ सभी कर्मचारियों तथा अधिकारियों द्वारा अधिक से अधिक हिन्दी में काम करने की शपथ से हुआ।

हिन्दी पखवाड़े के दौरान विभिन्न प्रतियोगिताओं जैसे निबन्ध लेखन, अनुवाद, कविता पाठ, वाद प्रतियोगिता एवं प्रश्नोत्तरी का आयोजन किया गया।

निदेशक महोदय ने कार्यक्रम के समापन समारोह में सभी कर्मचारियों/अधिकारियों को कार्यक्रम में भाग लेने के लिए सराहा तथा हिन्दी भाषा में टिप्पणी/ड्राफ्टींग करने के लिए सभी आस्थापन अनुभाग के कर्मचारियों की भी प्रशंसा की और पूर्ण वर्ष इसी तरह हिन्दी भाषा में कार्य करने की अपेक्षा की। अंत में मुख्य अतिथि श्री एस. डी. शर्मा ने विभिन्न प्रतियोगिताओं के विजेताओं को पुरस्कार वितरित किये।

Institute Foundation Day

The Centre celebrated its foundation Day on 18th January 2004. Dr P.G. Adsule, Director emphasised on the collective efforts of the staff members for the progress of the Centre. A lecture on 'Use of Yoga for various health treatments' by Dr. K.N. Dhumal was organized on the occasion. Staff members promoted during the year were also felicitated on this occasion. Dr. S.D. Ramteke was the convener of this programme.

Republic Day

The Centre celebrated the Republic Day on 26th January with joy and splendour. Dr. P.G. Adsule, Director, hoisted the flag. In his address, he emphasized the contributions of all the staff irrespective their category for the progress to fulfil the duties of the Centre towards farmers.

National Science Day

The Centre celebrated "National Science Day" on 28th February 2004 to mark the birthday of Noble Laureate Dr. C.V. Raman. Dr. Samannawar, former Head, IARI Regional Centre, Pune was the Chief guest on the

occasion. Dr. P.G. Adsule, Director welcomed the chief guest and briefed about the progress made at the centre to spread the good agricultural practices among the grape growers. A debate on " Should we promote drinking of wine in India?" was also organized. Several issues like positive effect of wine on health, employment generation, export potential, ill impact on Society and Indian Culture and possibilities of addiction were discussed. Dr Samannawar, Chief guest delivered a talk on "Plant quarantine in India" He opined that spread of viral diseases must be restricted to safeguard the interest of grape industry in the country. Dr Narendra Kulkarni, Scientist was the convener of the programme.

International Women's Day

The Centre celebrated the International Women's Day on 8th March 2004. A talk by Mrs. Jayashri Kadam, a trained Nutritionist, on 'Balanced Diet for women - childhood to old age' was arranged. The women casual labourers and the wives of the staff members were special invitees for this programme. A one to one interaction at the end of the programme helped the women participants to get expert advice from the nutritionist on their specific problems.

A discussion on 'Means for empowering women for better Indian society' was also arranged. The views of the participants on girl child education, better health care, change in attitude towards women, elimination of dowry and due recognition of women as home maker were thought provoking and emerged as the key issues to be addressed at the social level.

Official Language Implementation Committee

Several steps were undertaken to promote official language at the Centre as per the directives from Rajbhasha Vibhag, Government of India. All the rubber stamps were made bilingual. Different performa viz. leave application, joining reports, indents etc were made bilingual. Several administrative staff wrote file noting in Hindi and they were suitably awarded for their efforts. The meetings of Committee were held regularly and all efforts were made to promote the use of Hindi inspite of limited staff.

Institute Joint Staff Council

The first Institute Joint Staff Council (IJSC) was constituted with effect from October 2002 for a period of three years with Drs. G.S. Karibasappa, Indu S. Sawant, R.G. Somkuwar, Kaushik Banerjee and Sh. A.S. Murthy as members official side and Shriyuts L.R. Gopalkrishnan, U.N. Borse, B.J. Phalke, K.R. Raskar, B.R. Chakankar as members staff side and Dr. Anuradha Upadhyay and Sh. N.S. Pathan as secretaries from officials and staff side respectively. IJSC met on 16th March 2004 and discussed various issues related to better work culture and welfare of the staff.

Women Cell

Women cell was constituted under the Chairmanship of Dr. Indu S. Sawant and with Ms. Shailaja Satam and Mrs. Anita Mathew as members to look after the welfare of the women employees and cater to the issues and

grievances pertaining to them. The cell made arrangements for organising International Womens' Day on 8th march 2004.

Energy Audit

Dr. G.S. Karibasappa, Sr. Scientist (Horticulture) is nominated as Nodal Officer, Energy Efficiency and Savings Measures as per the directives from Govt. of India.

Intellectual Property Rights information and commercialization

As per council's directives, Dr. Indu S. Sawant was nominated as the nodal officer to sensitize the staff and look after the IPR issues, including coordinating with the IPR cell at the Head Quarter.

Consultancy Processing Cell

The CPC is functioning under the chairmanship of Dr. S. D. Sawant with Dr. R.G. Somkuwar, Dr. Anuradha Upadhyay, Dr. S. D. Ramteke and Dr. J. Sharma, AFAO, AAO and Ms. Shailaja V Satam as members to assess and process the proposals for consultancy, contract services, training, workshop etc.

Vigilance Officer

Dr. Anuradha Upadhyay, Sr. Scientist (Biotechnology) is appointed as Vigilance Officer with effect from January 2003.

Staff Welfare Association

The Centre's Staff Welfare Association was registered this year. The Staff Welfare Association organized one lecture cum demonstration on medicine free life (Naturopathy). It also made arrangements for celebrating Institute Day on 19th January 2004.

Other Committees

To look after the various activities of the Centre, the following committee were in operation:

1. Research Management & Coordination Unit
2. Technical Cell
3. Publication Committee
4. Store Purchase Committee
5. Farm Management Committee
6. Library
7. Works
8. Photography
9. Sports activities
10. ARIS Cell

METEOROLOGICAL DATA

Year & Month	Air temperature (°C)		Relative Humidity (%)		Pan evaporation (mm)	Day length (hr.)	Total rainfall (mm)	No. of rainy days	No. of rainy days with > 4 mm rain
	Min.	Max.	Min.	Max.					
Apr 2003	18.92	40.27	17.97	77.20	7.72	11.09	0.60	3	0
May 2003	21.66	39.34	23.06	87.71	8.15	12.33	0.40	2	0
Jun 2003	23.05	32.92	62.47	96.97	3.80	11.81	57.20	20	2
Jul 2003	22.26	30.51	79.94	100.0-0	3.13	10.81	28.00	11	1
Aug 2003	20.92	30.25	83.16	100.0-0	1.99	8.28	21.20	23	1
Sep 2003	20.01	31.61	71.30	100.0-0	2.63	6.36	8.40	8	0
Oct 2003	17.84	33.65	40.84	99.03	4.23	8.61	1.00	2	0
Nov 2003	15.60	31.25	40.07	98.17	4.18	9.91	3.40	6	0
Dec 2003	10.57	29.71	34.74	99.87	3.49	9.90	2.20	7	0
Jan 2004	10.55	29.62	35.61	99.74	3.63	10.28	1.80	4	0
Feb 2004	11.45	33.26	24.59	92.10	5.00	10.53	1.80	7	0
Mar 2004	15.56	38.48	13.52	73.45	7.04	11.09	0.80	4	0

Source : Weather station, NRC for Grapes, Manjri, Pune