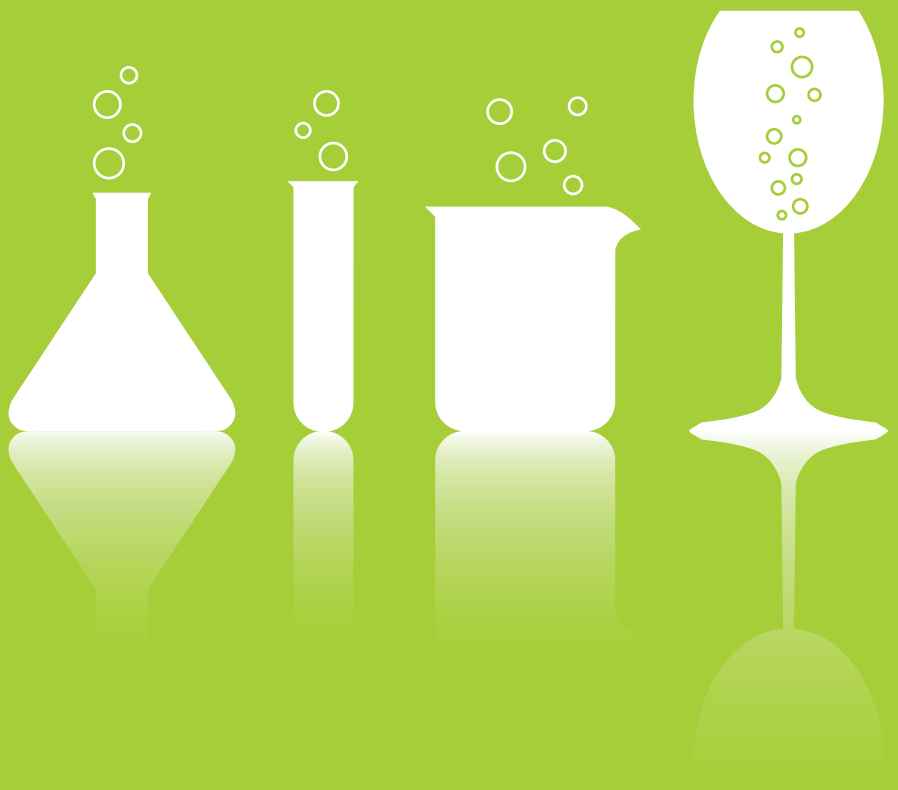
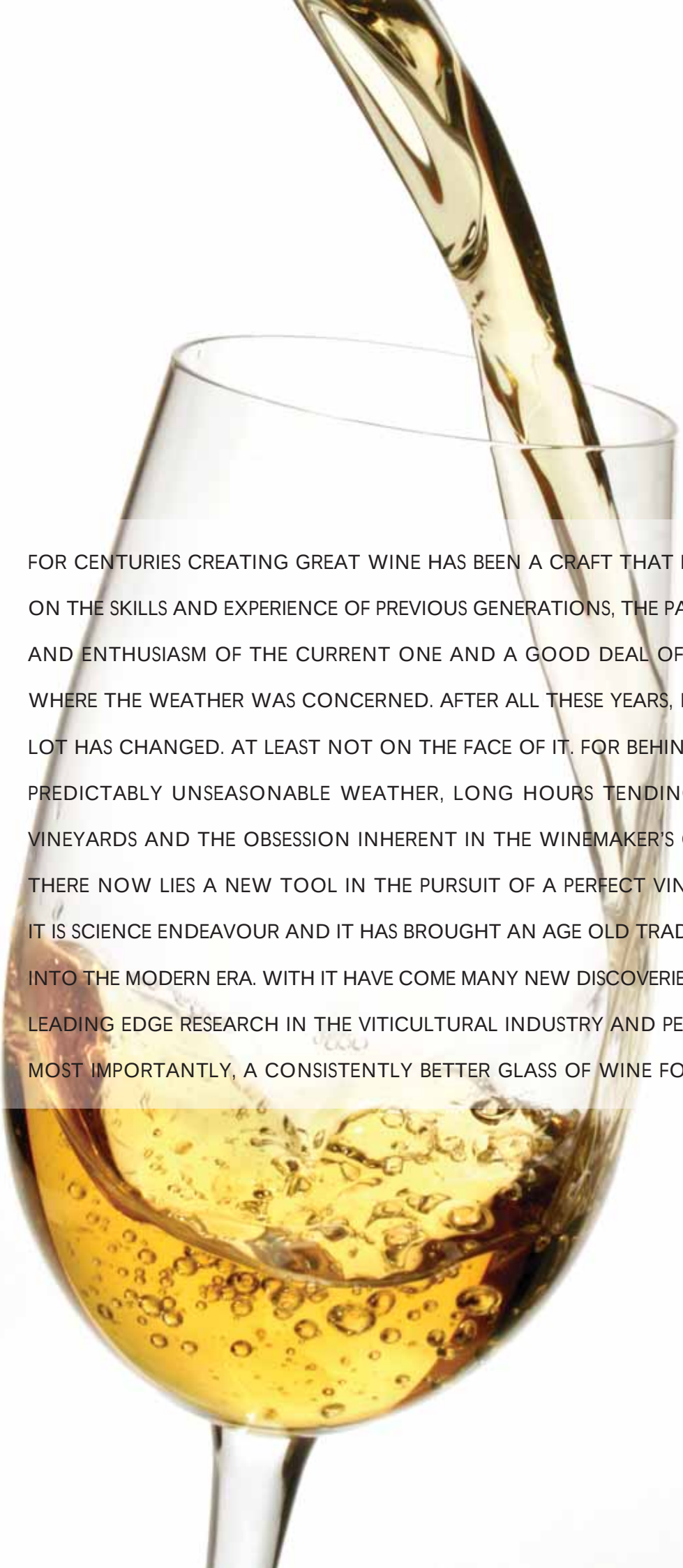


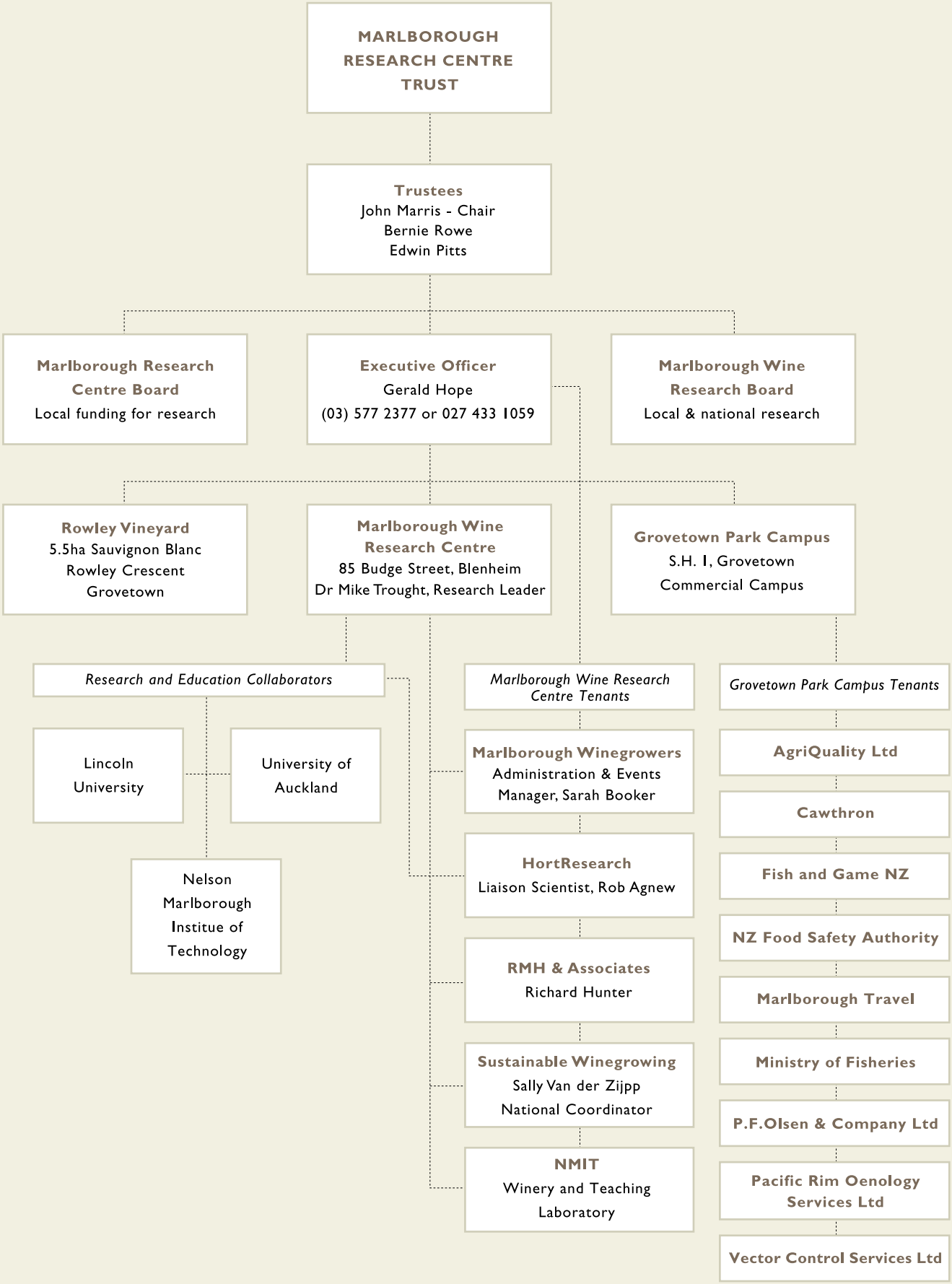
vintage research

MARLBOROUGH RESEARCH CENTRE of EXCELLENCE TRUST

ANNUAL REPORT 2006 / 2007



FOR CENTURIES CREATING GREAT WINE HAS BEEN A CRAFT THAT RELIED ON THE SKILLS AND EXPERIENCE OF PREVIOUS GENERATIONS, THE PASSION AND ENTHUSIASM OF THE CURRENT ONE AND A GOOD DEAL OF LUCK WHERE THE WEATHER WAS CONCERNED. AFTER ALL THESE YEARS, NOT A LOT HAS CHANGED. AT LEAST NOT ON THE FACE OF IT. FOR BEHIND THE PREDICTABLY UNSEASONABLE WEATHER, LONG HOURS TENDING THE VINEYARDS AND THE OBSESSION INHERENT IN THE WINEMAKER'S CRAFT THERE NOW LIES A NEW TOOL IN THE PURSUIT OF A PERFECT VINTAGE. IT IS SCIENCE ENDEAVOUR AND IT HAS BROUGHT AN AGE OLD TRADITION INTO THE MODERN ERA. WITH IT HAVE COME MANY NEW DISCOVERIES AND LEADING EDGE RESEARCH IN THE VITICULTURAL INDUSTRY AND PERHAPS MOST IMPORTANTLY, A CONSISTENTLY BETTER GLASS OF WINE FOR ALL.


MARLBOROUGH RESEARCH CENTRE TRUST
Trustees
John Marris - Chair
Bernie Rowe
Edwin Pitts
Marlborough Research Centre Board
Local funding for research
Executive Officer
Gerald Hope
(03) 577 2377 or 027 433 1059
Marlborough Wine Research Board
Local & national research
Rowley Vineyard
5.5ha Sauvignon Blanc
Rowley Crescent
Grovetown
Marlborough Wine Research Centre
85 Budge Street, Blenheim
Dr Mike Trought, Research Leader
Grovetown Park Campus
S.H. 1, Grovetown
Commercial Campus
Research and Education Collaborators
Lincoln University
University of Auckland
Nelson Marlborough Institue of Technology
Marlborough Wine Research Centre Tenants
Marlborough Winegrowers
Administration & Events Manager, Sarah Booker
HortResearch
Liaison Scientist, Rob Agnew
RMH & Associates
Richard Hunter
Sustainable Winegrowing
Sally Van der Zijpp
National Coordinator
NMIT
Winery and Teaching Laboratory
Grovetown Park Campus Tenants
AgriQuality Ltd
Cawthron
Fish and Game NZ
NZ Food Safety Authority
Marlborough Travel
Ministry of Fisheries
P.F.Olsen & Company Ltd
Pacific Rim Oenology Services Ltd
Vector Control Services Ltd

www.wineresearch.co.nz

AS AT 30 JUNE 2007

Marlborough Research Centre Trustees

John Marris		Chairman
Edwin Pitts		Trustee
Bernie Rowe	LL.B	Trustee
Gerald Hope		Executive Officer

Marlborough Research Centre Board Members

Edwin Pitts		Chairman
Francis Maher		Marlborough District Councillor
Michelle Williams	B.Hort.Sc(Hons), PhD	HortResearch
Ivan Sutherland	VFM, ANZIV	Marlborough District Council Appointee

Marlborough Wine Research Centre of Excellence Board

Ivan Sutherland	VFM, ANZIV	Dog Point Vineyard (Chairman)
Andy Frost	BSc(Hons)	Pernod Ricard New Zealand Ltd
Brian Jordan	BSc(Hons), PhD, MNZIFST, MRSNZ	Lincoln University
Philip Manson	BSc, DipBus	NZ Winegrowers
Damian Martin	PhD	Winegrowers of ARA
Bruce Campbell	BAgSc(Hons), PhD	HortResearch
Lily Belabun	BSc, PhD (London)	Nelson Marlborough Institute of Technology
Ben Glover	BCom, PGDip Oenology &Viticulture	Wither Hills Vineyards Marlborough Ltd

Marlborough Wine Research Centre Employees

Mike Trought	BSc(Hons), PhD	Research Leader
Wendy Parr	BA(Hons), PhD (Wine Science), PhD (Psychology)	Senior Research Officer: Wine Sensory Science
Christina Balmori	MSc(Hons)	Laboratory Manager (Resigned in May 2007)
Kerrie Stronge	BSc, M.Appl.Sc (Hons)	Research Winemaker
Jeff Bennett	BSc(Hons), PhD	Scientist
Trevor Skilton		Technician

Trust Support Staff

Maree Way		Executive Support Administrator
Cherryl Fitzgerald		Financial Administrator

HortResearch (Tenant)

Rob Agnew	BAgrSc	Liaison Scientist
Cherryl Fitzgerald		Research Centre Administrator
Marc Greven	BAgSc(Hons), PhD	Scientist
Dion Mundy	BSc, MSc(Hons)	Scientist
Sue Neal	DipHort, DipFieldTech	Research Associate
Victoria Raw	BSc(Hons Agri),GDip(Vit)	Research Associate
Margaret Roberts	BHSc	Technician
Emma Sherman	BSc(Tech)	Laboratory Manager
Carmo Vasconcelos	DSc, PhD	Senior Scientist
Bruce West		Technician

RMH & Associates (Tenant)

Richard Hunter	Dip Ag	Scientific Officer

Marlborough Winegrowers Assn Inc (Tenant)

Tom Trolove	BCom, MBA	Marketing Manager
Sarah Booker		Marketing Executive

Sustainable Winegrowing NZ (Tenant)

Sally van der Zijpp	M.Appl.Sc(Hons)	National Coordinator
Karen Bryant		Administrator

Rowley Vineyard

Allan Robertson

Funding Contributors

To Marlborough Wine Research Centre
as at 30 June 2007

New Zealand Winegrowers
Pernod Ricard New Zealand Ltd
Allan Scott Wines & Estates Ltd
Babich Wines Ltd
Charles Wiffen Wines Ltd
Clifford Bay Estate Ltd
Delegat's Wine Estate Ltd
Domaine Georges Michel Ltd
Forrest Estate Winery Ltd
Fromm Winery Ltd
Goldwater Estate
Highfield Estate
Huia Vineyards Ltd
Hunter's Wines (NZ) Ltd
Jackson Estate Ltd
Kaituna Vineyards Ltd
Kim Crawford Wines Ltd
Lawson's Dry Hills Ltd
Marlborough Bottling Company Ltd
Matua Valley Wines Ltd
Mud House Wine Company Ltd
New Zealand Wineries Ltd
Nobilo Wine Group Ltd
Ormond Nurseries Ltd
Riversun Nursery Ltd
Sacred Hill Wines Ltd
Spy Valley Wines
The New Zealand Wine Company
Tohu Wines Ltd
Vavasour Wines Ltd
Villa Maria Estate Ltd
Whitehaven Wine Company Ltd
Wine Marlborough
Wither Hills Vineyards Marlborough Ltd

Chairmen's Report

During the last three years the Marlborough Research Centre has established itself as a credible scientific research base, with strong links to the national and international research community.

Much of the last year was given over to dealing with the challenges of managing growth; directing capital into accommodating the needs of the scientists and technicians, completing final fit-out of laboratories and acquiring new equipment.

However, during the past year the Marlborough Research Centre Board also reviewed its future direction and looked at ways to ensure regional science projects are being delivered as efficiently as possible.

It became evident that changes were required to consolidate the three management structures under which the science team had been operating.

The Board was of the view that the scientific activity connected with the Marlborough Research Centre would be better coordinated under one coherent management entity dealing with the various funding streams which support the Centre's activities.

Therefore, HortResearch was asked to take a greater role as a key partner in the Marlborough Research Centre, handling all administrative and contractual responsibility for scientific programmes.

To achieve this transition smoothly, the full support and understanding of science staff was necessary.

We are pleased that all those scientific staff previously employed by the Marlborough Wine Research Centre agreed to make the transfer to HortResearch from July 1, 2007. All scientific equipment and other related items of plant also became HortResearch's responsibility from that time.

Key to this decision was the agreement that the management of the Centre's major research programme into Sauvignon Blanc, funded by the Foundation for Science Research and Technology, also be assigned to HortResearch.

The Board recognises that, first and foremost, the Trust is a facilitator, set up to source funding to underpin locally-based science projects. Secondly, it is a provider of facilities from which to base that work. But the Trust itself is better placed remaining at a distance from hands-on science project management where it was being required to employ scientists and technicians - with all the associated administrative duties.

During the last three years we have created a strong, recognisable profile for the Centre. We have built up substantial assets, with the Research Centre campus in Budge Street, Grovetown Park and the Rowley Vineyard, and the considerable return from those assets provide us with a secure source of revenue for re-investment in science. Our role now is to take an overview while maintaining our facilities and buildings and ensuring the infrastructure is there for local scientific activity.

Financial Performance

The Trustees are pleased with the final results of the past year and compliment staff and management for a successful outcome. Core revenues for the year have, in general, been maintained and rental income is as budgeted. However, the expanding research programme has carried with it a heavier burden of financial administration and accountability, prompting the restructuring decision referred to earlier.

- The Trust this year made a much greater contribution to the research projects. Direct funding of projects increased from $65,000 in 2006 to $154,000 this financial year. In addition, the operation of the Research Centre ran at a deficit of $74,000, which was funded by the Trust.

- In view of this increased funding of research projects, the net surplus of $115,600 which the Trust achieved for the 2006/07 financial year was very pleasing.

- The Trust has continued to build up its cash reserves which, after allowing for current liabilities, now stand at $1.125m.

The Trust acknowledges the unflagging support of the Marlborough District. . .

The Rowley Vineyard again produced a quality Sauvignon Blanc harvest cropping 70 tonnes from 5.5 hectares with the grapes being sold by public tender to the New Zealand Wine Company. The harvest was down from the previous vintage but net surplus increased.

Wine industry contributions are now currently descending as the five-year commitment tapers off, due to reach maturity in 2008 – 2009. It is anticipated this will be offset by increased research revenue from New Zealand Winegrowers.

In previous years the Trust has signalled the need for substantial capital expenditure. This situation remains unchanged. In summary, building consents and lease variations are almost finalised for construction of the research cellar and laboratory and estimated cost of construction is $220,000. Other staged development plans include storage buildings for scientific equipment, archives and dry goods. Timing of construction for offices is yet to be confirmed but the capital expenditure for these additions is estimated to be $650,000.

The major restructuring of the Trust's activities has meant that plans for extending the Research Centre in Budge Street have been delayed until the restructure has been completed.

In future, the Trustees are keen to fully develop the balance of its 13 hectares of land at Rowley Crescent although any decision will depend, in part, on future plans for the portion leased to the New Zealand Vine Improvement Group (New Zealand Winegrowers) and a decision about the future of its grape vine collection.

The Trust acknowledges the unflagging support of the Marlborough District Council. Its commitment allows the Trust to continue a research programme of importance to primary industries across the region.

Project summary

Funded by Marlborough District Council Grant	
Meteorological data recording and dissemination	$15,000
Long-term vineyard sustainability	$35,000
Trunk disease in Marlborough vineyards	$15,000
Managing clovers for hill country	$30,000
Drought-tolerant forage species	$5,000
Starborough-Flaxbourne soil conservation group	$10,000
	$110,000

Marlborough Environment Award

In conjunction with HortResearch, the Trust continues to provide supreme sponsorship, valued at $3,000, for this biennial event. The event is designed to showcase examples of successful businesses which incorporate sound environmental management techniques. This year, the Didemnum Working Group was awarded the supreme prize for its efforts to combat the invasive marine pest, Didemnum vexillum.

Liquorland Top 100 Wine Fellowship

In February, 2007, the first recipient of the Liquorland Top 100 Wine Fellowship visited New Zealand.
Liquorland's sponsorship package will bring scientists to New Zealand for viticulture research during the next five years and the Marlborough Research Centre is extremely grateful to Liquorland for this sponsorship. The inaugural visitor was Dr Doug Adams who has a Pinot Noir research programme at the University of California, at Davis, USA, and is highly respected within the international wine industry.
After visiting vineyards in Central Otago, Dr Adams spent time in Marlborough and the Marlborough Wine Research Centre hopes to establish a research relationship with his department at the University of California.

The Trust looks forward to receiving applications for the 2008 Fellowship.

Board Membership

Wither Hills winemaker Ben Glover was appointed to fill an existing vacancy on the Marlborough Research Centre Board.

We are sure he will make a valuable contribution towards the research needs of this province.

Staff Change

The Centre's Executive Administrator, Serena Cheesman, moved on during the year and was replaced by Maree Way.

The Centre has completed another successful year, consolidating its role in the national and international scientific community while enabling Marlborough primary producers access to regional scientific expertise.

As active participants in the promotion and practice of sustainable production we believe that the research investment to date has made a difference and will continue to assure our customers throughout the world that we produce food products of absolute integrity that should be preferred for their quality, pricing and purity.

John Marris
Chairman
Marlborough Research Centre Trust

Edwin Pitts
Chairman
Marlborough Research Centre Trust

John Marris
We need to take a broad approach to research and analysis, remembering that we have Marlborough-wide interests at heart. This transition is a logical move. It removes the duplication that was increasing as the Marlborough Research Centre was administering a growing research team. The bulk of the Centre's activity is in wine research but agriculture and pastoral research is also an expanding part of its work. We are committed to science projects of regional and national significance but the actual management and administrative control of those projects will rest with HortResearch. However the Research Centre must ensure it remains financially functional while retaining a robust approach to top quality, relevant research. That underlines the importance of maintaining existing partnerships with local rural-based industry as well as with winegrowers, locally and New Zealand-wide.

Edwin Pitts
The Trustees have carefully considered this strategic review of the Marlborough Wine Research Centre and the reorganisation plans. We are supporting the change as it more clearly defines the Trust's role and streamlines the management of the science projects, taking the Trust's function back to its original concept.
I hope it will be a more efficient management model. It should help to maintain the high level of accountability required for the public funding received by the Centre. HortResearch has the capacity to administer funding streams and source new funding, handle staff contracts and ensure scientific targets are delivered. I see these changes as a sign that the Centre really has 'come of age' and I hope the clearer definition of roles will make the best use of all resources as the Centre moves to the next stage of its development.

Chairman's Report

This year has seen a period of significant change for the Marlborough Wine Research Centre with the Board making some organisational decisions intended to be of long-term benefit to the Centre, its staff and future research programme.

From July 1, 2007, responsibility for the management and employment of research staff, and for the associated scientific plant, was transferred to HortResearch.

The restructuring underlines the good work done by staff to extend and broaden the Centre's research programme.

The Wine Research Board recognised that the future sustainability of the research programme required changes to its management and employment structure. It was increasingly clear that this reorganisation was also necessary for the future sustainability of the Centre infrastructure itself.

The Board wishes to acknowledge the important leadership role played by Research Leader Mike Trought, not only in taking the team through a period of change, but in helping to maintain good communication with the wider industry. The Board is pleased that Mike will continue to promote and advance the interests of the Research Centre – which means we can retain him as head scientist there.

The reorganisation was made possible because the Marlborough Wine Research Centre enjoys a close and cooperative relationship with HortResearch itself. We acknowledge the priority that HortResearch gives to viticulture in its research portfolio.

Ivan Sutherland
"It is very pleasing to see the Marlborough Wine Research Centre move to the next stage of its development. Our research programme continues to expand and the Centre is earning a commendable reputation for its work, associated with the continued sustainable development of the Marlborough and New Zealand wine industry.

New Zealand's future in the international wine market is going to require continued advances in viticultural and winemaking research and for the industry itself to push research along the path of innovation and ingenuity."

Wine Research Centre

It is pleasing to see the Marlborough Wine Research Centre developing capability and building a reputation as the centre of excellence for wine industry research in New Zealand. The Centre's buildings are increasingly well used for meetings, discussions and educational events. I am proud to see that the Centre has achieved such a prominent place in the wider industry in just three years.

Previous reports have noted the need for additional space at the Budge Street site, both extra winemaking facilities and office accommodation.

The pressure on office space remains. Staff members have, for the last year, been cooperative in sharing offices and even desks. They have not had the luxury of individual offices.

Planning for a dedicated microvinification unit is well advanced.

However, the Board is of the view that if this additional facility is to proceed, there will need to be strong industry support for its services as a small-batch winemaker, and it would need a secure long-term tenant to justify the level of expenditure that would be required.

The technology transfer theatre is proving to be a real asset for the Centre, providing a good space for industry gatherings and workshops. There is no doubt the good facilities have helped to attract large audiences to events held there, making it a popular venue with industry groups. That

in turn has helped maintain strong linkages with wine growers and to build the Wine Research Centre's reputation as the central point for region-wide events and activities of interest to the industry.

New Staff

We are fortunate to have secured the services of a new Senior Scientist, Carmo Vasconcelos, this year. Carmo is an eminent Pinot Noir researcher with broad international experience.

Christina Balmori, our Laboratory Manager, left during the year to take up a new role in Brisbane. Christina made an important contribution to the Centre, setting up much of the Centre's analytical equipment.

We have appointed a new Laboratory Supervisor, Emma Sherman, and a Research Associate, Victoria Raw – both appointments strengthen the mix of skills and capabilities we have at the Centre.

Board membership

The Board membership has been largely unchanged this year although I welcome the appointment of one of our region's talented young winemakers, Ben Glover, of Wither Hills. Ben takes the place of Ken Rogers, former General Manager of Framingham Wine Company Ltd, who relocated to Auckland.

Now that the organisational changes have been made, the Marlborough Wine Research Board structure will also need to be reviewed during the coming year.

I must convey my thanks to Board members for the contribution they have made during the last year. As chairman, I well understand the time and commitment they give to their duties and I appreciate the support they get from their various organisations in being able to attend to Board business.

Ivan Sutherland
Chairman
Marlborough Wine Research Centre Board

Research Leader's Report

The year has closed with an important restructuring step which will increase the capacity of the Marlborough Wine Research Centre and expand the breadth of experience here. All Centre scientific staff are now contracted to crown research institute, HortResearch. The move creates a closer working relationship with HortResearch. This will make the operation of the Centre a lot smoother; it will help consolidate us as a team and at the same time make us part of a bigger team, with all the benefits of the technical and administrative support of that larger body. Overall, the restructuring will clarify the role of the Centre and remove any blurring of the roles of funder and research provider. It leaves us free to put all our focus onto the research programme. It strengthens the relationship at various levels and will assist us to further develop our important partnerships with Lincoln University and the University of Auckland.

Dr Mike Trought
Research Leader
Marlborough Wine Research Centre

Over the last year we have consolidated a high-calibre staff which has created a very powerful viticultural and wine science team - establishing the Centre as the hub of wine research in this country.

The Centre's biggest project, the Sauvignon Blanc research programme funded by the Foundation for Science Research and Technology (FRST), is into its third year and we are currently in the midst of a review to confirm the progress that has been made.

In particular, it's pleasing that challenges with analytical technique have been overcome and enable us to achieve some exciting developments with fruit analysis for the various aroma chemicals we're looking at.

As we reach the half way point in the Sauvignon Blanc programme, we are just beginning to understand some of the factors that are controlling the flavours and aromas of our most important grape variety.

One of our biggest events this year was the presentation of the interim results of the Sauvignon Blanc research programme, in November. We had 120 registrations and the demand was more than we could accommodate, with presentations held in Marlborough and in Auckland. The high level of interest from the industry confirmed the importance of this project and we received much positive feedback afterwards.

Another highlight for the Centre this year was the increased professionalism we have attained with our own winemaking programme. Our microvinification facilities caps off the research programme here; it is not enough to simply understand what is happening in the vineyard, we must have some sort of capacity to understand what our research means in the final product. The ability to make the research wine, coupled with the level of evaluation given by the expert panel of professional winemakers to whom we have access, is rounding out our operation most satisfactorily.

The July announcement of FRST's funding for a product quality assurance programme for the 2007-08 year is another confirmation of the quality of the Centre's past performance and future proposals.

This particular programme is a significant allocation of funds for grapes and wine research and a major proportion of the work programme will come through the Centre.

Interestingly, the funding for our work in this programme will look at causes and consequences of variability in fruit

composition – in both Sauvignon Blanc and in Pinot Noir. This will be the Centre's first serious foray into Pinot Noir research and should give us some real traction in embarking on investigations into a variety which is potentially enormously important for both Marlborough and the wider industry.

The arrival early in 2007 of our new Senior Scientist, Carmo Vasconcelos, from Oregon State University, USA, is a noteworthy appointment to the Centre which also has implications for our Pinot Noir research.

As well as broad experience in grapes and wine research, Carmo's eminence in Pinot Noir research is unmatched in this country. She is internationally recognised for her work on this variety and she has an enormous international network of contacts. She is adding immensely to the capability of our operations.

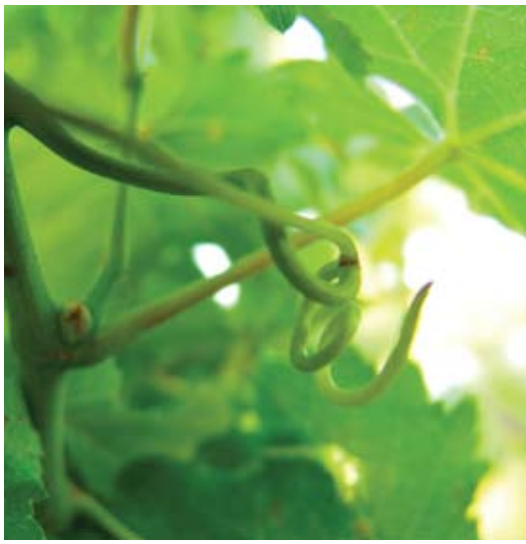
We were very sorry to say goodbye to our laboratory manager Christina Balmori who moved to Australia this year but with the appointment of Emma Sherman we have our laboratory continuing to run smoothly.

The Centre science team is steadily building international networks through its growing profile and speaking invitations of growing importance are coming through.
This year has seen the Centre built some important international relationships which we expect to bring valuable returns in the future.

One of the key relationships follows a visit here this year from Steve Lund, the manager of the molecular biology programme at the University of British Columbia, in Vancouver. This institution has a very powerful molecular biology programme dealing with grapes and wine and was looking for vine physiology expertise which we have been able to provide. Our collaborative programme will tie us in, with Lincoln and Auckland University staff, to an internationally significant research programme with implication for vine management.

One of Liquorland Limited's grants to viticulture research last year enabled us to invite Dr Douglas Adams from the University of California at Davis, USA, to visit New Zealand. Dr Adams is well known for his research into biochemical changes during grape ripening, the development of tannins and phenolics in the skins and seeds of red wine varieties, and the consequent level of tannins in wines.

We know we have some way to go before our Pinot Noir achieves anywhere near the distinction of Marlborough's Sauvignon Blanc but the working relationship we're now able to build with Dr Adams will greatly assist that progress.



Likewise the Centre is developing good connections with the University of Melbourne and I am currently supervising the work of two of their students.

The breadth of the Centre's research programme has helped to consolidate its sound reputation with other research organisations and the wider community.

Students have been made most welcome at the Centre again this year, working with us across a range of projects, in particular:

- Kelvin Joe, a Masters student from Auckland University who looking at the impact of nitrogen nutrition on thiol concentrations in Sauvignon Blanc wine

- Christina Cocchi, a visiting intern from Bologna University, Italy, investigating the physiology of grapevines

- Wen-Feng Hung (Regan), a Lincoln University student investigating causes and management of protein haze in Sauvignon Blanc

- Melissa Anne Talbot, looking at the influence of New Zealand's high UV light levels on grapevines, in particular amino acid metabolism of Sauvignon Blanc and Chardonnay.

- Melissa Sutherland, looking at the interaction of soil type and fruit shading on methoxypyrazine concentrations in Sauvignon Blanc.

The Centre's work programme is perceived as innovative and enterprising, which is adding to our profile in the research world. A very good example is the work being done by Wendy Parr, looking at the sensory analysis of wine from a psychological point of view. Traditional science examines the chemistry behind the wine and how its taste is achieved but Wendy is looking at how the wine drinker's brain interprets that chemistry. This is original work, which is enlarging the scope of the type of wine research being done and is likely to arouse international interest.

Not only are our scientists being invited to address international events and make presentations at seminars and workshops aboard, international speakers are increasingly interested in presenting to our audiences here. Our visitors and presentations are detailed elsewhere in this annual report but they included:

- Representatives from Australian company Specterra, on remote sensing

- Roy Thornton and Susan Roderigas, on new research on yeast behaviour in winemaking

- Dr Douglas Adams, University of California at Davis, USA.

Centre staff continued to contribute to the Focus Vineyard project funded by MAF's Sustainable Farming Fund and that project gives our scientists a good opportunity to maintain contact with the local wine industry.

There is of course a growing interest in sustainable practices, particularly in the light of climate change, focussing on the need to consider Sauvignon Blanc's potential to cope with that changing environment, including ways to modify vine management to minimise the impact of climatic effects.

We have come through a year of significant change and I would like to thank the Research Centre Trust and the Board for all their support. At the same time I would like to put on record my appreciation of the way staff members have responded to this year of change.

We also acknowledge and appreciate the continued support we receive from the wider industry in providing the Centre with financial support and resources – vineyard access, fruit and expertise. This backing means we can look to the coming year with optimism and confidence.

Mike Trought
Research Leader
Marlborough Wine Research Centre

Year In Review

Research visitors

- Elisa Ferrari, 2006 Romeo Bragato student, Italy
- Sonja Needs, Melbourne University, Australia
- Serena di Lenarda, PhD student, Italy
- Professor Steve Wratten and Dr Samantha Scarratt, Lincoln University, and Bart Arnst, vineyard manager
- Dr Steve Lund, Assistant Professor, Vancouver University, British Columbia, Canada
- Kathy Grigg, deputy chair, Grape and Wine Research and Development Corporation
- Dr Allan Woolf and Pia Rheinlander, HortResearch
- Dr Doug Adams, 2007 Liquorland research fellow, University of California at Davis
- Dr Jack Pinkerton, nematologist, United States Department of Agriculture, Agricultural Research Service, Corvallis, Oregon, USA.

Visitors

- Hon Jim Anderton, Minister of Agriculture.
- Darren Omecke, Provisor, Adelaide, South Australia
- Paul McGilvary, CEO HortResearch
- Nathalie Jacquet, Pernod Ricard research division, Paris
- Dr Norman Phillips and Dr Christian Sanchez, Lallemand,
- Hoani Ponga and Timotei Pahi, HortResearch Maori business staff.
- Dr Keith Smettem, lecturer in soil physics, University of Western Australia, Perth
- Bruce Gadd, national manager, Regional Economic Development, Industry New Zealand, Christine Spahn, marketing consultant to Eastern Europe and Jo Rainey, New Zealand Trade and Enterprise
- Tim Aitkin, "The Observer Magazine" and Anthony Rose, "The Independent", U.K.
- Elzette du Preez, winemaker, De Grendel Wines, South Africa

Visiting Groups

- Delegation of 12 Chilean grape growers
- Portfolio managers from Foundation for Research Science & Technology
- Team of Thai government officials
- HortResearch senior science managers
- International representatives of primary industry insurance companies
- Lincoln University Viticulture and Oenology student tour

Seminar/workshops held at MWRC

- Dr Steve Lund, Assistant Professor Vancouver University: Understanding Grapevine Genomics.
- Dr Nic Irvin, PhD,University of California, Riverside. The threat to NZ of the Glassy Winged Sharpshooter.

- Dion Mundy, HortResearch Marlborough: Trunk disease discussion group.
- Mike Trought, John-Paul Praat, Lincoln Ventures, Andrew Malcolm, Specterra Services and Michael Wells, Precision Viticulture Australia: The use of aerial mapping vineyards in vine management decisions.
- Dr Doug Adams, University of California at Davis: The role and measurement of tannins and phenolics in wine, in particular in Pinot Noir.
- Dr. Jack Pinkerton, USDA ARS: Nematode problems in winegrapes of the US Pacific north-west.
- HortResearch two-day meeting to discuss needs of the wine industry and

HortResearch capability.

- HortResearch Climate Change workshop.
- HortResearch workshop, Wine; Focus and Opportunities.
- Focus Vineyard
  - Marc Greven and Jeff Bennett: Yield estimation and grapevine training.
  - Mike Trought, Marc Greven and Andrew Naylor, Pernod Ricard: Yield management and estimation.
  - Mike Trought: Yield prediction in vineyards, February 2007.
  - Mike Manning, Dion Mundy and Robert Beresford: Grapevine trunk diseases and the impact of weather on grape diseases.

Other Presentations

- Agnew R., Trought M., Greven M., Bennett J. and Parr W. Effect of viticultural practice on Sauvignon Blanc aromas. 12th Romeo Bragato Conference, 2006.
- Ford R. J., Creasy G., Harrison R., Sherlock R. and Trought M. The effect of shading and crop load on the flavour and aroma compounds in Sauvignon Blanc grapes and wine. 12th Romeo Bragato Conference, 2006.
- Friend A.P., Creasy G. and Trought M. An investigation of berry types and their development in *Vitis vinifera*. 12th Romeo Bragato Conference, 2006.
- Greven M. Waste management in Marlborough vineyards. 4th international specialised conference on sustainable viticulture and winery wastes management, Vina del Mar, Chile. 2006.
- Greven M. New Zealand grape growing and research. Instituto Nacional de Investigaciones Agropecuarias, Chile. 2006.
- Maggu M., Winz R., Kilmartin P., Trought M. and Nicolau L. Effect of skin contact and pressure on the concentration of thiol precursors in Sauvignon Blanc must. 12th Romeo Bragato Conference, 2006.
- Mundy D. Vineyard diagnostics and the design of simple vineyard trials. Annual Sustainable Winegrowers regional seminars, September/October 2006.
- Parr W.V. Typicité of Marlborough Sauvignon Blanc. Centre Européen des Sciences du Goût, University of Burgundy, France, June, 2006.
- Parr W. Gisborne International Chardonnay Challenge guest speaker.
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- Grape Yield Assessments, January 2007

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- Lucas R., Final report Supreme Sub-Clover FITT, Lincoln University, 2007.

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New Staff

Victoria Raw – Research Associate

Victoria began work with HortResearch Marlborough in October 2006, moving over from a role as viticultural technician at Pernod Ricard New Zealand Ltd.

A Londoner, her university studies took her to Edinburgh University, Scotland, where she completed a BSc (Hons) in General Agriculture. With Portuguese family connections near Lisbon, she then spent a year working in Portugal's port wine industry.

From there, Victoria travelled to South Australia's University of Adelaide where she completed a Graduate Diploma in Viticulture in 1999. She arrived in Marlborough in 2000 and has now taken out New Zealand citizenship.

Victoria has been working on irrigation trials, research into berry size development, meteorological data analysis and assisting with Vinefax, soil analysis looking at carbon storage levels and working on the Centre's regional Sauvignon Blanc trials.

Emma Sherman – Laboratory Supervisor

Emma's first practical employment was at Tetley Tea in London. Originally from Tauranga, she studied for her BSc (Tech) majoring in Chemistry at Waikato University in 2005 before taking the London work placement to complete her degree. After 14 months there, and at the end of her work visa, she returned to New Zealand before joining HortResearch Marlborough in May, 2007. A key part of Emma's role at HortResearch is keeping the laboratory safe and properly stocked.

Maree Way – Executive Support Administrator

Maree took on the role of executive support administrator to the executive officer at the Marlborough Research Centre in November 2006. Maree has a background in administration within the energy and forestry sectors, coupled with more than four years experience selling real estate in Marlborough and Nelson. She is responsible for administrative support, health and safety standards, liaising with tenants and organising events at the Centre.



Carmo Vasconcelos – Senior Scientist

Carmo brings with her 23 years experience in research into cool climate vines, including a key role advising the developing Pinot Noir industry in Oregon, USA.

With a Portuguese-Swiss family background in scientific academia, Lisbon is home although her life has taken her across four continents. Carmo completed her university studies in both Lisbon and Zurich to become an agricultural engineer. Her PhD in grapevine physiology (1990) is from the Swiss Federal Institute of Technology in Zurich. Her post-doctorate studies centred on sustainable viticulture, in Switzerland, and on grapevine cold hardiness, at Michigan State University, USA.

That led to her appointment as Associate Professor (Viticulture) at Oregon State University in 1994, where she was in charge of research and was also the state-wide extension education specialist in grapes.

"It was great to be deeply involved with a variety as it was becoming established in a comparatively new region. I was there for 13 years and I helped them to start a sustainable viticulture association, working very much in a tutorial style, with workshops and so forth. Today Oregon's Pinot Noir industry is internationally successful and is highly attuned to the importance of sustainable viticulture and this is serving them well," she says.

Carmo arrived at the Marlborough Wine Research Centre in February, 2007.

With such extensive experience with Pinot Noir under her belt, she is an authority on this notoriously tricky grape variety.

"It's a very challenging variety and I like challenges. Why Pinot? Well it was just fate really. In the German-speaking part of Switzerland where I was, Pinot Noir is the only red variety that is grown, and I have just stayed with it right through my career."

Carmo's expertise is with Pinot Noir but, as Senior Scientist, she heads the Marlborough Wine Research Centre team's research into both Pinot Noir and the region's signature grape, Sauvignon Blanc.

"Pinot Noir is gaining importance here. It's a very high quality wine with a niche market. It needs a lot of science behind it in order to grow it well because it's a very difficult variety," she says.

Although Carmo's role here is research-based, she says the satisfaction is in sharing research results and greater understanding.

"I hope I can help the industry here to grow and be good at what it is doing. For me, the reward is when I hear one grower explain to another grower what I have taught him."

"The Oregon growers all know about rootstocks, they all know about physiology, because I always told them I cannot give you recipes, I can give you tools and with those tools you can go forward," she says.

Carmo's multi-lingual (French, German, Italian, Portuguese, and English) background and her extensive network of contacts enables her to stay up to date with European research.

Marlborough Wine Research Centre - a winery on a small scale

A small-scale winery experimenting with style and flavour at the Marlborough Wine Research Centre is looking for the prototypes to take the New Zealand wine industry into the future.

Kerrie Stronge
Research Winemaker

This small but potentially influential research activity within the Centre's Sauvignon Blanc programme is quietly expanding, making experimental wines to the same high standard as commercially made wines, but producing them in very small batches for research purposes.

It's a very precise science.

Research winemaker Kerrie Stronge, working under the leadership of Mike Trought, is steadily developing this important dimension to the research capacity of the Centre.

The Centre's small-scale winemaking operation has completed a third vintage and is currently evaluating the impact of fruit ripeness, soil type, regional differences and yield on Sauvignon Blanc wine style. It is also undertaking limited commercial microvinification for external clients.

Small-scale winemaking concentrates on the scientific dimension of winemaking, rather than the commercial or consumer imperatives.

In the continuing quest for improvements within the industry, small-scale wine-making can help to establish how fine-tuning the technology or adjusting the practices can affect the quality of the final product.

It's a specialised skill, focussing on perfecting the many elements that are part of winemaking – anything from the selection of a vine clone or a refinement in the fermentation process.

This operation has the potential to offer its research expertise to suppliers and manufacturers of winery products as well as to the winemakers and winegrowers contemplating developing or implementing new technologies or new materials.

It's an important service, for example, for nurserymen importing new clones who, before they make their own commercial decisions, want to see what flavours are expressed in the new varieties.
Kerrie brings solid scientific expertise to the little winery, drawing on her experience within the industry in Marlborough and Australia's Hunter Valley, coupled with a background in research and microvinification. Her Bachelor of Science in microbiology first took her into the oil and gas industry. She followed that with a Master of Applied Science in wine science with first class honours from Lincoln University. Her Master's thesis investigated different juice treatments of Pinot Gris and their effects on the wine made from them. Kerrie's job is to make and research trial wines from the various tracts of vines across Marlborough accessed by the Centre. She makes her wines in 18-litre batches. This is winemaking in the purest sense of the science.
"My wine is used in sensory experiments, to evaluate and quantify the sensory characteristics of the wine, and in chemical analysis by the scientists at the Centre. For example, I have a client at present for whom we are testing the sensory dimension of a range of clones which are just coming

Small-scale winemaking allows the winemaker to examine how the variations in viticultural practises and technology can affect the final quality of the product. With small-scale fermentation it's possible to accurately measure the impact of each step of the process and to assess the affect of each input. *~ Mike Trought*

"We are only in the infant stages of what could be achieved here for clients in future. There is scope for research at all levels. We could consider investigations into anything from yeast and agro-chemicals or even specific research project for individual wineries. If New Zealand is to maintain its marketing edge, we must look ahead at what could be done with the current style of our Sauvignon Blanc and where it could go in the future. It's important that we are working now on the prototype wines of the future; the new styles and flavours that will help us maintain that edge." ~ *Gerald Hope*

out of quarantine. So I make the wine and they will eventually choose the clones they want to produce on a big scale, to supply the industry."

Some improvements have been made since Kerrie's first vintage when she was working with 34-litre fermentation containers. This year she's moved on to stainless steel kegs which she says are a marked improvement.

"This is still quite experimental but we're making advances all the time. Sometimes it's a challenge to modify the equipment for small batch winemaking but that just tests our inventiveness and forces us to think outside the square. Small scale winemaking requires you to be adaptable – for example I don't have a pump, which is a pretty standard piece of winemaking equipment. I've had to rely on gravity instead!"

Kerrie sees herself as very much a winemaker but working to a different market.
"The science drives the winemaking but this is winemaking in purest sense of the craft. And even though I'm working with small quantities, I still get that sense of relief that every winemaker experiences when the wine is finally in the bottle."

Yield management and prediction

Grapevine yield is central to determining the profitability and quality of winegrowing. Despite this, the industry is poor at anticipating and managing yield. The scientific literature of the past 80 years has contained many research reports discussing the impact of weather conditions at flowering and during the initiation of bunches, and the role of over-wintering reserves on the subsequent development of the vine and the potential crop levels. While it must be accepted that in some seasons catastrophic events such as a frost or hailstorm may have an unpredictable influence on yield, a yield estimate should be possible using weather (which largely determines bunch number and weight) and cropping (which determines over-wintering reserves) records in the current and previous season.

The Centre's yield management and prediction research programme seeks to understand factors influencing grapevine yield, with the aim of developing a robust yield predication system that will enable the industry to adapt vineyard practices to ensure consistent grape supply.

Project: Yield prediction in vineyards - influence of cane and spur size on fruitfulness of Sauvignon Blanc

Background

Marked inter-seasonal variation in grapevine yields is frequently observed. The lack of consistency results in differences in fruit and wine quality, problems with fruit intake in wineries and challenges in the market. While yields are largely determined by weather conditions at inflorescence initiation and during flowering, Perold (1927) commented that the size of the crop in the previous season may also affect subsequent yields.

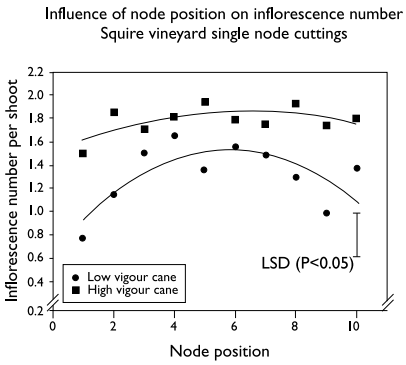
The impact of cropping and associated shoot development on fruitfulness of Sauvignon Blanc vines has been studied for the past three years.

Vines on four vineyard sites in the Wairau Valley and one in the Awatere Valley were selected for the study. Vines were pruned to either 2-cane or 4-cane and during the mid-winter, two shoots (a large and small) were selected from each of eight replicate vines (note: these shoots then become high or low vigour canes). Shoot size was measured either by recording the diameter at the third internode, or by weighing and measuring the length of the shoot from the base to node 10. The basal 10 nodes from each shoot were grown in tap water in a heated glasshouse for approximately six weeks. At this time, the inflorescence number and position on the developing shoot was recorded.

Inflorescence numbers were also recorded on the vines growing in the field in the following season. The diameter of internode three of the canes retained after pruning was measured, and the number and position of inflorescences on the developing shoots recorded by node position.

Key results

The number of inflorescences per shoot was significantly (P<0.001) influenced by node position along the cane and cane size. Of particular importance to spur pruned vines is the low fruitfulness of the low vigor canes at the basal node positions. However, the data suggests that spur pruning may be an option for Sauvignon Blanc, providing spur size is adequate. Similar responses were observed at all five sites and in the field in the subsequent growing season.



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Light, photosynthesis and carbohydrate management

Light influences grapevine development in two main ways. Firstly, the quantity and quality of light intercepted by leaves influences the rate of photosynthesis and, in turn, the vine's accumulation of sugars. Secondly, light intercepted by the developing fruit influences the composition of the berries and, in turn, the juice.

Photosynthesis by the vine during the growing season produces sugars which are either accumulated as sugars in the developing fruit or as storage reserves, particularly in the roots and trunks of the vine. In the spring, early season shoot development depends on remobilisation of these reserves. Understanding the factors that determine the partitioning and subsequent utilisation of carbohydrates to the fruit, roots, shoots and storage organs is important for balanced cropping.

Project: Influence of perennial wood volume on pinot noir yield and fruit composition

Background

The influence of vine age on fruit composition is the subject of much discussion with a generally held view that older vines produce better fruit. However, this has not been rigorously tested and any mechanisms are vague. In some cases, it is suggested that it is simply a marketing ploy invoked by vineyards with old vines. The objective of this project is to test the hypothesis that increasing the amount of perennial wood per vine, as the result of vine aging or manipulation of training system, increases the storage of carbohydrate reserves in the trunks and cordons. These reserves, in turn, provide an energy capacity within the vine which can be drawn upon during periods of carbohydrate shortage - for example during post-veraison berry ripening.

A trial investigating the influence of perennial wood (grapevine reserve system) on the ripening and yield of mature pinot noir (clone 777) grapevines was established in a cool-climate region of Marlborough (Waihopai Valley). Alternative training systems were designed and imposed on previously 2-cane trained vines in 2001 with the aim of changing the proportion of perennial wood in the vine system relative to number of nodes per vine. The four training systems used included two conventional systems (2-cane and Spur) and two alternative systems that used a bilateral permanent cordon with two canes trained inwards (Trought-Fistonich) or outwards from the end of the cordons (Trought-Gandell). The training systems all utilised vertical shoot positioning during the growing season.

Key results from this year

The flowering progression of Spur vines was slightly later than 2-cane. This was the result of greater variation in shoot to shoot flowering in 2-cane versus Spur. In 2-cane vines shoots positioned at the end of the cordon were more advanced in their flowering than equivalent positions on Spur vines. Shoots on Spur vines were much more uniform in their flowering regardless of position (results not shown).

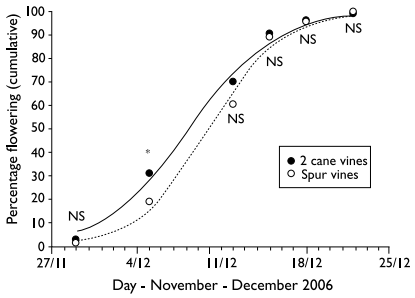

Figure 1: Influence of training system on Pinot noir flowering progression. *and NS = significant and not significant respectively at 5% level.

Two-cane vines yielded significantly less than all other training systems, which is primarily attributable to a lower bunch number per vine (Table 1). Bunch weight was similar across all training systems. At harvest Spur vines had lower Brix and the higher titratable acidity compared with all other training systems. Juice acidity (pH) was not affected. Brix levels did not reflect the difference in yield (crop-load) brought

Table 1 Influence of Pinot noir pruning system on yield components and fruit composition at harvest 2007.

Pruning system	2-cane	Spur pruned	Trought-Fistonich	Trought-Gandell	Significance
Perennial wood volune	**Low**	**High**	**Med High**	**Med High**	
Yield components:					
Bunches per vine	53	60	60	63	***
Yield per vine	1.9	2.4	2.4	2.3	***
Mean bunch weight	37	40	41	39	NS
Fruit composition at harvest (23/3/07):					
°Brix	21.6	21.3	21.9	21.6	*
pH	3.58	3.56	3.60	3.58	NS
Titratable acidity (g/L)	6.0	6.3	6.1	6.2	*

NS, *& *** = not significant and significant at the 5 and 0.1 percent level respectively.

about by the use of different training systems (Table 1).

Conclusions

The apical dominance of shoots at the end of 2-cane cordons significantly advanced flowering compared with shoots at other positions on the cordon, resulting in more within vine flowering variation. This may have implications for the uniformity of fruit ripening and maturity levels within a vine.

In the 2007 season, increased perennial wood volume appeared to convey some advantage to increasing vine yield though increased bunch number per vine. This may be the result of either improved bud burst, and hence shoot number, or an increase in the fruitfulness of shoots. This will be examined in the future.

Fruit ripeness, in terms of Brix and titratable acidity, was influenced by training system, but not in response to vine yield (crop loading). Other factors, such as canopy structure, may have impacted on some fruit ripeness parameters.

Key funding sources and collaborating companies

- New Zealand Winegrowers
- Marlborough Wine Research Centre
- Tyntesfield Vineyard, Waihopai Valley, Marlborough
- Villa Maria Marlborough

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Project: Influence of training systems on the yield and fruit composition of cool climate Marlborough Sauvignon Blanc

Background

Over the past decade, Marlborough's Sauvignon Blanc grape crop has been primarily produced using the high-yielding pruning intensive 4-cane Vertical Shoot Positioned (VSP) training system (Figure 1). In cool, late or high-cropping seasons achieving desired fruit ripeness levels by commercial harvest time using this training system may prove unattainable. Altering yields through crop load manipulation



by means of training system is one way of controlling ripeness levels but has received little research attention in Marlborough. An on-going trial has been established with the objective of determining the influence of commercial training systems on the yield and fruit ripening and composition of Sauvignon Blanc. Spur, Mid-height Sylvoz, 2-cane and 4-cane Vertical Shoot Position (VSP), and Scott Henry training systems were established on mature Sauvignon Blanc vines previously trained to 4-cane VSP in 2003.

Key results from this year

The training systems significantly altered vine yield mostly through their effect on bunch number, bunch weight and, to a lesser extent, on berry weight. Berry and bunch weights were lower on Sylvoz vines but a higher bunch number resulted in a heavier yield compared to other training systems (Table 1).

Yield (crop-loading), as manipulated by training systems, impacted negatively on fruit ripeness (Brix level) at commercial harvest (Table 1, Figure 2). However, in the 2007 season this relationship was influenced by soil moisture. High yielding dry north blocks could not attain the same Brix level as equivalent yielding wet south blocks (Figure 2). Juice pH and titratable acidity were not significantly different (Table 1).

Table 1: The effect of grapevine training system on yield components and fruit composition 2007

Training System	Scott Henry	Spur	Sylvoz	4 cane	2 cane
Yield components:					
Bunches / vine	95b[1]	81c	129 a	85 c	56 d
Yield / vine (kg)	10.7 ab	8.7 c	11.3 a	9.1 bc	7.0 d
Bunch weight (g)	113 b	107 bc	87 d	106 c	124 a
Berry weight (g)	2.04 bc	2.07 abc	1.95 c	2.17 ab	2.25 a
Fruit composition at harvest:					
brix	19.7 bc	21.4 a	18.9 c	20.3 b	21.5 a
pH	3.00	3.04	3.00	3.00	3.03
Titratable acid (g/L)	8.14	8.13	8.09	8.33	8.90

[1] Means within the same row with the same letter are not significantly different at $LSD_{(5\%)}$

Table 2: Comparison of 4-cane and Spur training over the last four seasons

Harvest Date	2 May 2004		26 Apr 2005		30 Mar 2006		9 Apr 2007	
Training System	**4 cane**	**Spur**	**4 cane**	**Spur**	**4 cane**	**Spur**	**4 cane**	**Spur**
Yield components:								
Bunches / vine	70 a[1]	55 b	73 a	61 b	71 a	63 a	85 a	81 a
Yield / vine (kg)	10.9 a	6.1 b	7.5 a	5.9 b	7.6 a	7.6 a	9.1 a	8.7 a
Bunch weight (g)	155 b	110 b	104 a	95 a	107 a	120 b	106 a	107 a
Berry weight (g)	-	-	1.97 a	2.02 a	2.13 a	2.29 b	2.17 a	2.07 a
Fruit composition at harvest:								
brix	-	-	22.0 a	22.7 b	21.9 a	22.3 a	20.3 a	21.4 b
pH	-	-	3.00 a	2.79 b	3.06 a	3.09 a	3.00 a	3.05 a
Titratable acid (g/L)	-	-	12.3 a	13.0 b	3.1 a	8.5 a	8.3 a	8.1 a

[1] Means with the same letter for each pair-wise comparison are not significantly different at the 5% level.

Spur vines took two seasons (following original conversion in July 2003) to reach a yield balance with 4-cane (Table 2). Since then, Spur vines have achieved a higher soluble solids (Brix) ripeness than equivalent yielding 4 cane. Yearly fluctuations in yield components and ripeness for both systems are also observed (Table 2).

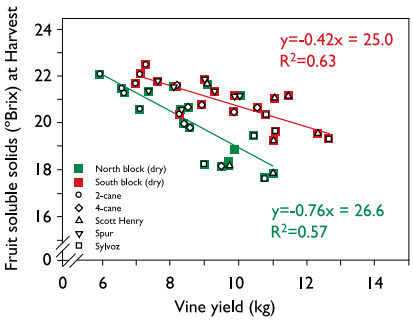

Figure 1: Relationship between vine yield and fruit soluble solids (°Brix) as influenced by training system and block position 2007.

Conclusions

Improved or earlier fruit ripeness (Brix) can be achieved by using training systems that reduce vine crop load (eg 2-cane).

Conversely, lower or delayed Brix ripeness can be induced by using high cropping systems like Scott Henry and Sylvoz. Findings to date suggest that Spur pruning

(following a conversion period) may be a viable alternative to traditional 4-cane pruning in Marlborough. Spur pruning, unlike 4-cane pruning, can be partially mechanised, reducing winter pruning labour and hence overall annual grape production costs.

Key funding sources

- Marlborough Wine Research Centre
- New Zealand Winegrowers
- Villa Maria, Marlborough (Mike Croad and Jeff Cottle)

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Project: Influence of UV-B radiation on grape composition

Background

New Zealand has high levels of ultraviolet-B (UV-B, 290-315 nm) radiation, which are up to 50% higher than at comparable northern hemisphere latitudes. This is partly due to the depletion of the stratospheric ozone layer during recent decades. Compared to visible light, UV-B radiation is a minor component of the solar spectrum. Yet it has the potential to disproportionately affect metabolic processes in humans, animals, plants, and micro-organisms.

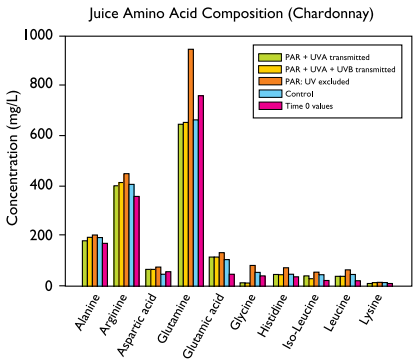
The New Zealand wine industry is renowned for producing high quality products from a range of grape varieties. Increased UV-B radiation can change the biochemical composition of grapes, and thus can impact on the nature of the wine produced. Although New Zealand wines are known for their fruit-driven style, their ageing ability is often criticised thus the variation in ageing characteristics is of concern to the wine industry.

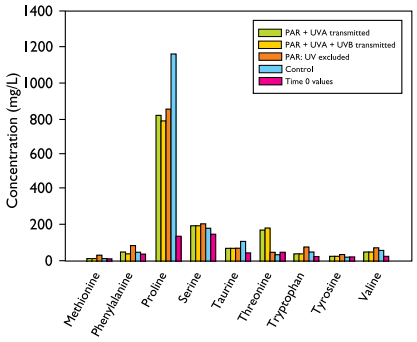
It is possible that the response of grapes to UV-B radiation is a factor in that variation. The effects of UV-B radiation on grape composition in white wines have been studied in some varieties. However, UV-B effects on amino acid metabolism and wine ageing characteristics have not yet been investigated. This project will study the effects of ambient UV-B levels in New Zealand on biochemical grape composition in Sauvignon Blanc and Chardonnay varieties, and how this affects aroma compounds and wine ageing characteristics.

Frames containing plastics with different spectral transmission properties were constructed to protect chardonnay vines from UV radiation for 35 days at the Lincoln University vineyard. The plastic filters transmitted either UV-A (315-400 nm) and UV-B, UV-A only, or no UV radiation. Grapes from these three treatments were harvested in April, 2007, and compared to vines with no UV filter protection (the 'no-frame control') and with fruit collected at the start of the experiment (Day 0). Amino acid analysis was conducted at Lincoln University using high-performance liquid chromatography (HPLC).

Key results from this year

Nineteen amino acids were detected. In some cases, differences in concentrations may be attributed to changes in UV radiation. For example, glutamine concentrations were approximately 300mg/L greater in juice from treatment where no UV radiation was transmitted. glycine and threonine concentrations in the juice were greatest in the treatment where no UV was transmitted, but were also similar to the no-frame control, suggesting that leaf removal may be influencing cluster exposure. One of the largest changes in concentration was noted in proline (a non-yeast available nitrogen source in grape juice) with an up to 10-fold increase in concentration over the period of the experiment (day 0 to harvest) and an approximately 300mg/L difference between no-frame control and treatments. It is possible that this is a micro-climate response, caused by protection of the vines by the frames.





These preliminary experiments have demonstrated the marked influence UV radiation may have on grape juice composition, with likely effects on wine quality. In addition, responses have also been noted that could be attributed to micro-climate effects, particularly for the accumulation of the non-yeast available amino acid proline.

Further studies will investigate in more detail the effects of UV radiation on grape composition during the upcoming 2007/2008 growing season.

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Project: Influence of pruning time on yield, fruit composition and vine phenology of Sauvignon Blanc vines

Background

Labour requirements in Marlborough, particularly for pruning vines, is increasing as the area in production expands. The onset of cane pruning in Marlborough is generally delayed until leaf fall, when it is believed that carbohydrate reserves and cane maturity is complete.

However, in cool climate New Zealand conditions, photosynthates are predominantly used to ripen fruit and from harvest onwards, low temperatures, short days and associated leaf senescence suggest that little accumulation of carbohydrate reserves in roots and trunks of vines appear to occur.

This is unlike vines growing in warmer climates, where vines accumulate significant carbohydrate in trunks and roots post harvest. The need to accumulate adequate over-wintering carbohydrate reserves by harvest provides an interesting challenge to grape growers. Adequate reserves are needed to ensure bud break and early season shoot growth in the following season are rapid and uniform. However, the accumulation of reserves is sensitive to vine yield and may partly depend on leaf activity post-harvest.

Understanding vine yield and time of pruning influence the carbohydrate accumulation in the perennial trunks and roots of the vine and how this is influenced by time of pruning and crop load will provide an understanding on the medium and long-term effects of date of pruning on vine performance.

Sauvignon Blanc vines were pruned to either 2-cane (24 nodes per vine + spurs) or 4-cane (48 nodes per vine + spurs) on four different occasions from three weeks after harvest in May, July, early-September and late-September (just pre-bud break). After the first pruning, vines were "stripped off" after three weeks to allow leaves to die. Pruning and stripping was undertaken on the same day. Canes for all treatments were laid down at the same time in late September. Shoots at node positions 3, 5, 7 and 9 along a cane were tagged for subsequent measurement.

Key results from this year

The number of canes retained after pruning had no significant effect on the time of flowering, although two cane pruned vines had lower yield and higher soluble solids at harvest, when compared to 4-cane pruned vines at harvest. Early and late pruning




slightly delayed flowering, but had no consistent effect on yield or soluble solids (Table 1). Flowering occurred earlier on shoots at apical node positions when compared to shoots arising close to the head of the vine, particularly where pruning was delayed until late September (Table 2).

In Marlborough, the start of pruning is generally delayed until leaves have senesced, often four to six weeks after harvest. Starting earlier would provide a longer pruning window and more efficient use of labour, but this should not be at a cost to vine productivity.

Results from the first year of this trial suggest that, while pruning shortly after harvest or before bud break may delay flowering, it has little influence on yield or soluble solids. However, late pruning in particular appears to increase the variability in flowering date, which may be reflected in variability in fruit composition. This will be investigated in future.

Key funding sources

- New Zealand Winegrowers

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Table 1: Influence of pruning time and cane number retained on flowering, yield and soluble solids of Sauvignon Blanc

	2-cane pruned vines				4-cane pruned vines			
	Early May	Early July	Early Sept	Later Sept	Early May	Early July	Early Sept	Later Sept
% flowering*	39	49	47	25	27	76	51	20
Yield / vine (kg)	3.9	3.4	3.4	3.8	7.7	7.0	7.3	6.5
Soluble solids (°Brix)	21.9	21.6	21.9	21.5	20.1	20.8	20.8	20.5

*Data is presented for basal inflorescences assessed on December 4

Table 2: Influence of node position and time of pruning on flowering*

Node	Pruning Time			
postion	Early May	Early July	Early Sept	Late Sept
3	11.5	44.5	16.0	5.0
5	36.5	57.8	38.7	1.6
7	46.5	64.5	56.3	40.2
9	57.0	81.4	86.0	44.5

*Data is presented for basal inflorescences assessed on December 4

Project: Impact of differences in soil type on vine phenology, growth and fruit composition of Sauvignon Blanc in a Marlborough vineyard

Introduction

Marlborough Sauvignon Blanc has an international reputation for style and quality but the extent to which this can be attributed to the climate, soils or vineyard management is at present unclear. However, the young alluvial soils of the Wairau Plains are considered to play an important role in determining this unique wine style.

Marked differences in soil texture occur within short distances, even within a single vineyard. These changes often run at right angles (east-west) to the north-south orientation of vineyard rows, leading to variation in vine growth and vigour along vineyard rows.

Grapevines (MS Sauvignon Blanc on SO4 rootstock) at the Squire Estate vineyard, central Wairau Plains, were selected to represent five categories of size/vigour; extra small (XS), small (S), medium (M), large (L) and extra large (XL). The sizing was

based on measured trunk circumference which ranged from 16cm on stony soils to 22cm on deep silt soils (Figure 1). The vines were 11 years old and trained to 4-cane vertical shoot position.

Key results from this year

The distribution of trunk circumference reflected vine vigour, as measured by canopy density and pruning weight, and was correlated to observed soil type and an electromagnetic (EM38) soil survey of the property in 2005. (results not shown).

Within the vineyard, sites with stony soils produced smaller, low vigour grapevines that exhibited advanced phenological development when compared with larger vines on deep silt soils. Fifty percent bud burst, flowering and veraison in XL vines were significantly delayed by eight, one and ten days respectively compared with S vines (Figure 2a & b).

Table 1: The effect of grapevine size/vigour on yield components and fruit composition at harvest (13 March 2006).

	Xtra Small	**Small**	**Medium**	**Large**	**Xtra Large**	Statistical Significance
Yield components:						
Yield / vine (kg)	4.6	4.1	4.9	4.2	4.0	NS
Bunches / vine	55	47	56	52	50	NS
Mean Bunch weight (g)	83	77	86	81	80	NS
Mean Berry weight (g)	1.9	1.8	1.8	1.9	1.9	NS
Yield to Pruning weight ratio	2.7	2.3	2.4	1.9	1.4	***
Fruit composition at harvest:						
°brix	22.1	22.4	21.9	20.9	19.0	***
pH	3.08	3.10	3.05	2.99	2.90	***
Titratable acid (g/L)	10.9	10.4	11.3	12.3	16.1	***
Malic acid (g/L)	4.4	4.2	4.5	5.1	7.8	***
Tartaric acid (g/L)	7.2	6.8	7.4	7.8	8.1	*
M/T acid ratio	0.6	0.6	0.6	0.7	1.0	***
IBMP (ng/ml)	4.9	5.6	13	10.4	8.3	NS
IPMP (ng/ml)	2.2	2.2	2.8	3.4	2.8	NS

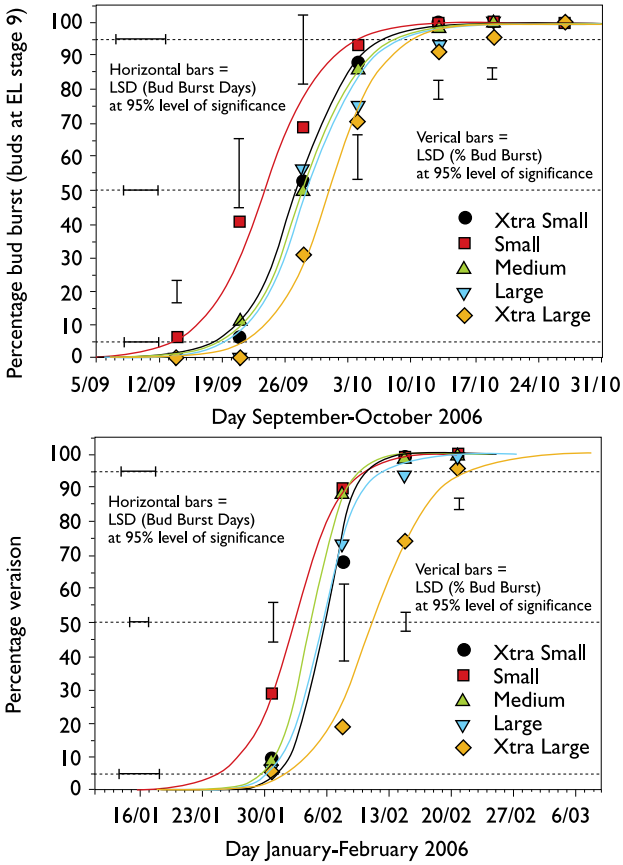
NS = not significant, *, ***, significant at 5% and 0.1% level respectively

Soil type and vine vigour had little effect on yield components, however vine balance (yield to pruning ratio) was lower in larger vines on deep silt soils (Table 1).

Marked differences in fruit composition were found at harvest time. Smaller, low vigour vines had higher Brix, pH and lower titratable acidity, tartaric and malic acid levels and ratios compared with larger vines. The levels of methoxypyrazines (IBMP & IPMP) in grape juice were not significantly different due to high variability within the vine size groups (Table 1).

Figure 1: XS stony site (left) and XL deep silt site (right). Photos courtesy of Tim Mills, Auckland University

Figure 2: Influence of vine size on percentage bud burst (A), and veraison (B) progression (cumulative).



Conclusions

Vine vigour, as dictated by changes in vineyard soil type, has a major influence on grapevine phenology and canopy structure which, in turn, has distinct effects on fruit composition and ripeness. It may be argued that the variation in fruit ripeness at commercial harvest contributes to the distinctive flavour and style of Marlborough's Sauvignon Blanc wine.

Key funding sources and collaborating companies

- Foundation for Research Science and Technology
- Auckland University
- Lincoln University
- Rod Brailsford, Pernod Ricard New Zealand Ltd

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Characterisation of volatile and non-volatile fruit composition and quantification of the influence of fruit processing and winemaking on their concentration

The balance of a multitude of volatile and non-volatile chemicals determines wine style. In many cases the precursors of the chemicals in wine originate in fruit and are released during the winemaking process. The degree of release may be modified by the techniques used during winemaking (yeast type, fermentation temperature, skin contact time, etc). The Centre's research seeks to characterise and understand both the chemistry and sensory properties of fruit and wine, the relationship between the fruit composition and wine attributes and the extent to which the latter may be modified by winemaking.

Project: Influence of harvest time on sensory properties of Sauvignon Blanc wines (2006 harvest)

Background

A survey of viticulturists and winemakers at the November 2006 Sauvignon Blanc Workshop in Marlborough identified fruit compositions (Brix, pH and TA) which may be targeted to produce the archetypal Marlborough Sauvignon Blanc.

A preliminary investigation to evaluate how changes in ripeness influence the sensory appreciation of wine was undertaken, harvesting fruit from the Marlborough Research Centre's Rowley Crescent vineyard at weekly intervals in April 2006.

Winemaking was completed using the Centre's standard protocols and triplicate wines were made from each harvest date. This provided a "quality" standard of our winemaking techniques, allowing between and within harvest comparisons to be made. Sensory analysis was undertaken by 19 wine industry professionals participating in the study using 10 flavour descriptors selected on the basis of previous research and three scales (concept, balance and palate weight) relating to global aspects of wine appreciation.

Key results

Juice soluble solids increased from 21.8 to 22.7 oBrix, while the titratable acidity decreased from 12.1 to 9.7 g/L over the two week harvest period. The "green" descriptors, leafy and grassy declined, while the "riper" descriptors, boxwood, passionfruit, stonefruit and tropical, increased. No changes were measured in capsicum, herbaceous, mineral or citrus character of the wines. The concept, balance and palate weight of the wines all increased as harvest date progressed. Results emphasize the importance of harvesting fruit of similar ripeness if wine sensory properties are to be evaluated in field trials.

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Project: Sensory Evaluation of Sauvignon Blanc wine

Background

Two major areas of investigation are underway to try and understand how

humans perceive the complex flavour and aroma characteristics that determine any given wine. These studies examine the way wine is evaluated, from a psychological perspective, as well as provide data about sensory responses to Sauvignon Blanc.

One area of study, considering the psychological aspects of wine evaluation, involves investigation of perception, memory, conceptualisation, and language relevant to experience of wine. The project is in collaboration with Dr Isabel Urdapilleta, University of Paris 8, France, and Professor Catherine Dacremont, University of Burgundy, France.

A second study is considering the Sensory Evaluation of Sauvignon Blanc wine.

This has two main aims:

- to elucidate the critical aroma and taste characters that define the concept "Marlborough Sauvignon Blanc" with focus on flavours assumed to have their source in two groups of chemical compounds: volatile thiols and methoxypyrazines

- to undertake sensory evaluation of research wines from viticultural and oenological manipulations that are likely to modify grape, must, and wine components that influence perception of key sensory characters.

Both areas of study focus on improving current sensory methodologies.

Key results from this year

Investigations into the psychological aspects of wine evaluation were conducted at the Centre's sensory facilities early in 2007. Wine professionals and wine consumers described Marlborough Sauvignon Blanc wine in a semantic (memory-based) condition and in a perceptive (sensory-based) condition. The data have been sent to the University of Paris 8 where they are currently being analysed with specialist software.

In the Sensory Evaluation of Sauvignon Blanc component of the project, two experiments have been conducted at the Centre's sensory facilities:

- A *Time of Harvest* study involved sensory evaluation of research wines from the 2006 vintage. Winemaking was completed using the Centre's standard protocols and triplicate wines were made from each harvest date. This provided a "quality" standard of our winemaking techniques, allowing between and within harvest comparisons to be made. Sensory analysis was undertaken by 19 wine industry professionals participating in the study using 10 flavour descriptors selected on the basis of previous

research and three scales (concept, balance and palate weight) relating to global aspects of wine appreciation. Nine Sauvignon Blanc samples were taken at three different harvest times (three levels of fruit ripeness) with wines made in triplicate. Two evaluation sessions were held, one week apart. The concept, balance and palate weight of the wines all increased as harvest date progressed. Juice soluble solids increased from 21.8 to 22.7 oBrix, while the titratable acidity decreased from 12.1 to 9.7 g/L over the harvest period. The data suggest that ripeness level does have a statistically significant influence on flavour profile, balance, and structural aspects of the resulting wine, and the degree to which a wine is judged as reflecting typicité (i.e., as being a good or ideal representation of Marlborough

Sauvignon Blanc wine). The study will be replicated with wines from the 2007 vintage.

- A *Regional Wines* study involved sensory evaluation, by wine professionals, of the 2006 research wines from five different vineyard sites in Marlborough, each site having two cropping levels. Thirty wines will be evaluated using winemaker-developed flavour and aroma descriptors. The data will be compared with that from the 2005 vintage wines.

Key funding sources

- New Zealand Winegrowers
- Foundation for Research, Science & Technology
- Marlborough Wine Research Centre
- Lincoln University
- O-I New Zealand

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Project: Protein stabilisation of New Zealand Sauvignon Blanc

Background

Sauvignon Blanc accounts for more than 70% of New Zealand wine exports. This variety has relative high levels of grape-derived proteins and requires higher bentonite addition rates for achieving heat stability. Alternatives to bentonite fining and/or reducing bentonite use have long been a goal of the wine industry.

Grape proteins may be a major cause of turbidity in white wine. While these proteins are only present in low concentrations, wineries typically fine wine with bentonite to prevent haze developing in the bottled wine.

Unfortunately, this results in a loss of wine volume and also lowers wine quality, resulting in a loss of wine value. Identifying the proteins involved and ascertaining how viticultural and oenological management practices influence their concentrations in juice and wine may provide useful direction for reducing the risk of wine haze formation and eliminating corresponding treatment costs.

The purpose of this study is to quantify and characterise proteins in New Zealand Sauvignon Blanc in different vintages and to understand effects of grapevine growing conditions, management and winemaking processes on their concentration and profile.

Key funding sources

- Foundation Research Science and Technology (TIF Fellowship)
- New Zealand Winegrowers
- Marlborough Wine Research Centre
- Pernod Ricard New Zealand Ltd

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Project: Genetic control of flavour and aroma development in Sauvignon Blanc grapes

Background

Typically the tropical fruit characters prevalent in Marlborough Sauvignon Blanc wines are due to the presence of the thiolated short chain carbon molecules, 4-mercapto-4-methyl-pentanone (4MMP), 3-mercaptohexyl acetate (3MHA) and 3-mercaptohexanol (3MH).

These compounds are formed during fermentation by yeast action on precursor

compounds that accumulate in berry tissues throughout berry development. These precursors are cysteinylated catabolites (enzymatic end-products) of glutathione conjugates of pentenal and hexenal. The exact nature of the biochemical pathway that produces these precursors is currently unknown.

This project's current working hypothesis is that thiol-aroma precursors are products of lipid breakdown during berry development which are subsequently conjugated with glutathione (a tri-peptide commonly added to small molecules to reduce intracellular toxicity) and transported to the cell vacuole.

Research therefore is concentrated on identifying and characterising the genes/proteins responsible for three critical steps in the production of these flavour and aroma precursor compounds, the 'activation' of fatty acid substrates by lipoxygenase, the cleavage of these reaction products by hydroperoxide lyase and the penultimate conjugation of the end-products of this pathway with glutathione by glutathione-S-transferase.

Key results from this year

Using publicly accessible genomic databases containing large numbers of grape derived sequences, four lipoxygenase genes that are expressed in grape berries have been identified.

LOXA putatively belongs to the 13-LOX class of chloroplastically localised lipoxygenases and is the most likely candidate for production of hexenals (the most likely compound utilised for the formation of C6 thiol-precursor compounds).

The researchers have also cloned 2 distinct LOXB isoforms which putatively belong to the 9-LOX class of lipoygenase and a third LOX family member, LOXD, which is not obviously related to either the 13 or 9 LOX branches of this multigene family. These genes appear to be expressed throughout berry development and the research is currently exploring which tissues each gene is expressed within. All LOX genes have been cloned into recombinant protein expression vectors to allow the production of pure protein for biochemical analysis. The researchers have obtained significant amounts of LOXA protein and are conducting biochemical analysis to define the preferential biochemical activity of this enzyme. This study is believed to be the first to explore the specific biochemical activities of individual LOX enzymes in grape berries.

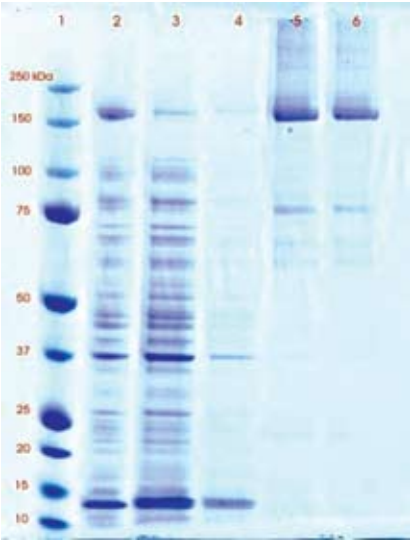
Unlike the LOX gene family, the HPL gene family is much smaller, consisting of one or two members with a single gene expressed in grape berries. Like the LOX genes, the grape berry HPL is expressed throughout

berry development and researchers have also produced recombinant protein expression vectors for the production of pure protein for analysis. These experiments are ongoing and have produced significant quantities of soluble protein for analysis.

Glutathione-S-transferases are a large gene family which consists of three distinct classes in plant genomes. At the current time there are more than 55 distinct GST sequences available in publicly accessible genomic databases of which more than 30 have some level of expression in grape berries. The challenge of this part of the project is to identify those enzymes that exhibit activity against the proposed substrates of hexenal and petenal.

The researchers have begun cloning and expressing individual GST genes that have shown patterns of gene expression consistent with knowledge of timing of production of thiol-precursors. To date, five independent recombinant protein

expression vectors have been produced and expressed the corresponding GSTs in our host system. To augment this approach, using published enzyme assays, the research will take a traditional biochemical approach to identify GSTs that possess catalytic activities against hexenal. This combination of approaches will greatly enhance detection of those activities among the 55-plus GST proteins that are involved in the glutathionation of hexenal and pentenal substrates.



SDS-PAGE gel of crude E. coli extracts and affinity purified fractions expressing recombinant NUSA:LOXA fusion protein. Lane 1 molecular weight marker; lane 2 total soluble protein; lane 3 Supernatant after binding; lane 4 Supernatant (wash 1); lane 5 Eluted protein (fraction 1); lane 6 Eluted protein (fraction 2).

Key funding source

- Foundation for Research Science and Technology

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Project: Development of functional genomics tools to support grape research in New Zealand

Background

One of the current challenges in grape research is the lack of suitable genetic resources and tools to allow the conformation and identification of the function of isolated genes. These tools are particularly important for grape-based research projects like the Marlborough Wine Research Centre's Sauvignon Blanc project as it investigates the biochemical and physiological processes behind flavour and aroma.

A set of Sauvignon Blanc, Cabernet Sauvignon and Pinot Noir cell cultures are being prepared and being tested for their ability to produce secondary metabolites (such as thiol precursors and methoxypyrazines). The production of such metabolites indicates an active biochemical pathway that is very likely to be the same as that expressed in the mature grapevine. Isolated genes will be identified which are involved in these pathways. By suppressing the activity of these genes, and measuring the production of specific metabolites, their function can be tested in the cultures.

Research is also focusing on the genetic basis for the production of 'sports' within vineyards of the Marlborough region. The production of both white and red sports on Pinot Gris bunches has proven to be quite a common phenomenon. Recent international research has shown the production of white grape varieties is due, in part, to the insertion of 'jumping-genes', or transposons, into regions on the grape genome that control berry pigment formation. In this project it is hoped to determine whether it is the same group of genetic elements that are responsible for white berry sport formation.

Material has been collected from various Marlborough vineyards that have produced sports. A genetic analysis of this material is underway to determine whether it is possible to increase the frequency of sport formation to a level that is sufficient for using these elements as a vehicle for new variety production. In addition these elements are very useful for the generation of clonal gene typing tools for clone identification.

Sauvignon Blanc callus culture (left) and Pinot Gris and Pinot Blanc berry and bunch sports indicative of 'jumping-gene' or retrotransposon activity in vines seen in Marlborough vineyards in the 2006-07 growing season. Growers are encouraged to note any differences in vine and berry growth and development that might be considered a potential sport and to make contact with the project.

Key results from this year

A wide range of cell cultures from all three species have been produced.

The next step is to develop a range of gene transfer tools and determine methods for elicitation of specific biochemical pathways.

A significant range of sports has been identified within Marlborough vineyards and cuttings have been obtained for propagation. Genetic analysis of this material is planned for the coming year.

Key funding source

- Lincoln University Research Fund

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Project: Micro-fermentation technique

Background

In viticultural research, fruit production is often a limiting factor when wine production is concerned. Because of this, researchers are usually forced to use modified micro-scale fermentation methods which are typically scaled down in volume and vary in respect to fermentor shape and fermentation management. Of particular concern is anecdotal evidence suggesting that these research wines frequently have faults, their extraction is not representative of larger scale fermentations, and as a result, their relevance to commercial practice is suspect.

To avoid winemaking issues, viticultural research often restricts investigations to fruit composition, and draws conclusions on wine composition solely based on fruit analysis. It must be kept in mind however, that for solutes that are derived from the solid tissues of the berry, fruit extraction during wine production depends not only on the amount of solute material present in the fruit, but also on their extraction kinetics. For example, proanthocyanidins (tannins) are a class of phenolics whose composition in wine is difficult to predict

based upon fruit measurements.

The purpose of this study is to determine if a reproducible micro-scale fermentation technique can be used to produce wines from small viticultural and enology trials, and to determine if the resultant wines can be compared to commercially produced wines.

Fermentations were conducted on Pinot Noir grapes of the same clone and rootstock, originating from a homogeneous commercial vineyard. Standard measurements of soluble solids, pH and titratable acidity were performed in random fruit samples. Triplicate random 200 berry samples, collected from harvested fruit, were used for the extraction and analysis of skin and seed phenolic composition.

One sample of Pinot Noir grapes was fermented according to standard commercial winery practice at Nobilo's winery. For the micro-scale winemaking,

fruit clusters were randomly collected from the same harvest bins used for the commercial fermentations. Fruit was de-stemmed by hand and divided into uniform lots. Fermentation took place in closed four-litre glass jars equipped with fermentation locks. Berries (3.5 kg) were crushed using a hand-operated crusher. Sulfur dioxide was added at 50 ppm, the same rate used in the commercial fermentations. Musts were inoculated with *Zymaflore F15*™ (Laffort Oenologie, Bordeaux, France), the same yeast used in the commercial fermentations and fermentation temperatures were kept similar, between 24 and 26°C. After primary fermentation, wines were inoculated with Viniflora Oenos malo-lactic bacteria (Chr. Hansen, Hørsholm, Denmark) at the manufacturer's recommended rate and kept at 15°C.

A factorial design was used to vary extraction and exposure to oxygen:

- the fermentation cap was kept submerged at all times with the help of a food-grade, high-density plastic screen in half of the micro-fermentors.
- punch down of the cap with the same frequency as in the commercial fermentations was performed in half of the micro-fermentors.
- two pressing techniques were used with half of the ferments pressed with a micro-bladder press and the other half pressed using using a vacuum filtration technique, designed to minimise exposure to oxygen.

Each micro-fermentation treatment was replicated three times. Daily monitoring of fermentations was done for changes in must density and temperature through the air-lock opening. Musts and wines were sampled every two days (through the air-lock opening, with a 50ml plastic syringe fitted with plastic tubing) from the center of the fermentation vessels, and stored at -80°C until analysed.

Phenolic composition, volatile acid, wine color density, hue, and bisulfite resistant pigment will be determined on micro-fermented and commercial fermented wines using standard analytical procedures.

Key results

At the time of writing this report, wines have completed malo-lactic fermentation and will be bottled after cold stabilisation.

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Influence of soil texture, moisture and fertility on volatile and non-volatile composition of fruit

The Centre's research is looking at the relationship between soil environment, vine growth and fruit composition. Water stress at key developmental stages of vine growth can influence both vegetative and fruit development. The degree of stress depends on soil water availability, determined by vine rooting volume and soil type, rainfall and evapotranspiration and may be modified by management factors such as irrigation and canopy management.

Project: Influence of berry size on juice aromatic compounds in Sauvignon Blanc

Background

This project, which began in 2004 as part of the Quality New Zealand Wine programme with funding from the Foundation for Research Science and Technology (FRST), aims to identify the major contributors to the quality of Marlborough Sauvignon Blanc and how these parameters can be influenced. All aspects of grape growing and winemaking are being investigated, from climate, terroir, grape clones and the management of the vines in the vineyard, to the winemaking, the yeasts used and even the genetic make-up of the yeasts.

The objectives of this study are to identify which yield parameters have an impact on the juice constituents, and how these parameters can be influenced in the field. Mainly based on research in red grapes, the hypothesis is that berry size and/or berry size distribution influence the juice quality.

In order to create different sizes of berries and different distributions, vines at Pernod Ricard New Zealand Ltd's Squire Estate vineyard were manipulated by applying different levels of irrigation and by separating vigorous (Large) and non-vigorous vines (Small). The three irrigation levels were control (IR-100), 60% and 20% of control (IR-60 and IR-20). So far, very few differences in berry size or berry size distribution have been found among the irrigation regimes at Squire Estate F block, or among the five different regional vineyards that have been studied over the last two years. Berries have been separated in size groups for further study into their basic characteristics and their constituents. At harvest, fruit soluble solids (oBrix) was found to be lower for bigger berries while titratable acidity (TA) was higher, both indicating an earlier maturity for smaller berries.

Key results from this year

This year a nil irrigation treatment (IR-0) was introduced to try and get some differences between treatments. In several vineyard rows, individual bays of four vines were selected based on their vigour, determined by vine trunk diameter, and then allocated to the IR-0 treatment.

Despite a random selection, it became clear that one of the four replicate bays of IR-0 was on more stony soil and all vines in this bay did not perform as well as the others in canopy development (expressed as leaf layer number or LLN) bunches per vine and yield. However, this did not affect the average performance of IR-0 significantly compared with the other treatments and, surprisingly, on average no differences were found among the treatments for yield, bunch weight, berry weight, juice pH or TA (Table 1).

Significantly fewer bunches per vine were found in IR-0 than in IR-20 and IR-60 (but not compared with IR-100). However, berries in IR-100 were found to be

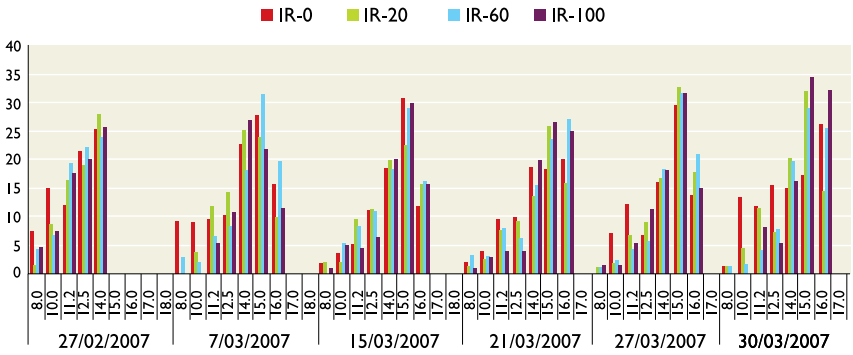
significantly higher in soluble sugars (°Brix) at harvest time than those in all three other treatments (Table 1). These results are very much in line with results found in the previous two years.

more berries in IR-0 are small could well play an important role in the determination of juice compounds. However, no results are available yet for either thiol precursors or isobutyl methoxypyrazine.

Table 1: Yield and juice quality parameters for Sauvignon Blanc grapes under different irrigation treatments, 2006-07.

Treatment	weight(kg)	Bunch weight (g)	bunch#	LLN	Berry weight (g)	°brix	pH	TA (g/L)
IR-0	4.46	87.3	51 b	3.01	1.62	19.1 b	3.22	7.68
IR-20	5.68	79.7	71 a	3.35	1.68	20.1 b	3.21	8.17
IR-60	5.80	81.7	71 a	3.62	1.74	20.0 b	3.09	9.24
IR-100	4.86	77.5	63 ab	3.57	1.92	21.7 a	3.16	9.03
Sign	ns	ns	*	ns	ns	*	ns	ns

Figure 1: Distribution of berry size in Sauvignon Blanc grapes under different levels of irrigation.



IR 0-100 = Irrigation levels as a percentage of the control; TA = titratable acidity; LLN = leaf layer number; Sign. * = values reflect a significant difference at P<0.05; ns = not significant at P<0.05. Values in a column followed by a different letter are significantly different at P<0.05.

Despite the lack of significant difference in average berry size at harvest, some trends for smaller berries for IR-0 can be seen from Figure 1, showing the development of berry distribution over time. The fact that

IR 0-100 = Irrigation levels as a percentage of the control; (8.0, 10.0, 11.2, 12.5, 14.0, 15.0, 16.0, 17.0) = Berry size classes measured in millimetres.

Key funding sources and collaborating companies

- Foundation for Research Science and Technology
- Pernod Ricard New Zealand Ltd

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Project: Influence of irrigation timing on berry development in Sauvignon Blanc

Background

For the last six years, irrigation trials have been carried out at Pernod Ricard's Squire Estate Vineyard, with whole rows of vines as irrigation treatments and replicates. Although these rows gave good field representation, high variability of the soil across the vine rows caused low significance of differences between the treatments.

Past research at Nautilus Estate (Neal & Dryden, 2005) suggested that water stress before veraison resulted in the biggest reduction of berry size. This agrees with literature stating that the reduction of cell multiplication cannot be undone at a later stage of development. However, water stress after veraison (hence after cell multiplication has stopped) can be compensated for at a later stage during cell growth.

Thus, a fully moisture-controlled irrigation trial was set up in 70-litre containers, protected from rain. Six treatments are being applied, one of which is the control with full irrigation during the whole season, and there are five treatments with varying periods of minimal irrigation.




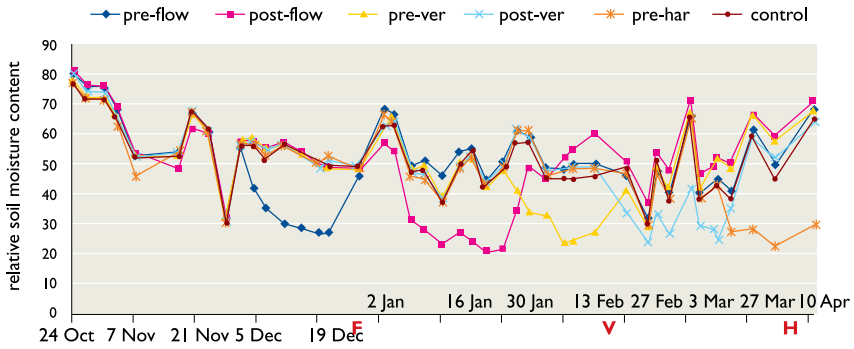

Figure 1: Soil moisture changes under different irrigation treatments for Sauvignon Blanc grapevines, planted in 70 L containers, 2006-07.
F= flowering, V = veraison, H = harvest.

Key results from this year

In the first year of the trial there were unexpected vine water status issues because of vines growing out of the containers and into the soil. As a result the field setup was changed, with the containers raised and covered by a reflecting plastic sheet to reduce warming of the root ball. Now it is possible to control soil moisture (Figure 1) and the treatments more effectively.

In 2006-07 most Sauvignon Blanc vines had uncharacteristically high numbers of small berries. Between veraison and harvest, the small berries grew from 0.57 g to 0.78 g, while the "normal' berries developed from 1.43 g to 1.84 g per berry. The small berries were analysed separately from the 'normal' sized berries, and were consistently higher in soluble solids content (oBrix), slightly higher in pH and lower in titratable acidity (TA). Across all berries, the pre-flower dry treatment had no effect on berry development, but the post-flower treatment reduced berry size initially (Figure 2). However, by the time of veraison, the average berry size in this post-flower treatment was similar to those in all the other treatments. The most severely affected berries were from vines that were under water stress during pre-veraison. Berries from this treatment were reduced in size after implementation of the treatment, and never grew as large as those in the other treatments. The yield on these vines was lowest for both pre-veraison treatments, because of smaller bunch and berry sizes (Table 1). However, the lowest oBrix across big and small berries – suggesting the slowest maturation – was found in the post-veraison treatment. Further analysis of frozen berry and bunch samples will give more clarity about the phenological stages most vulnerable to drought stress.

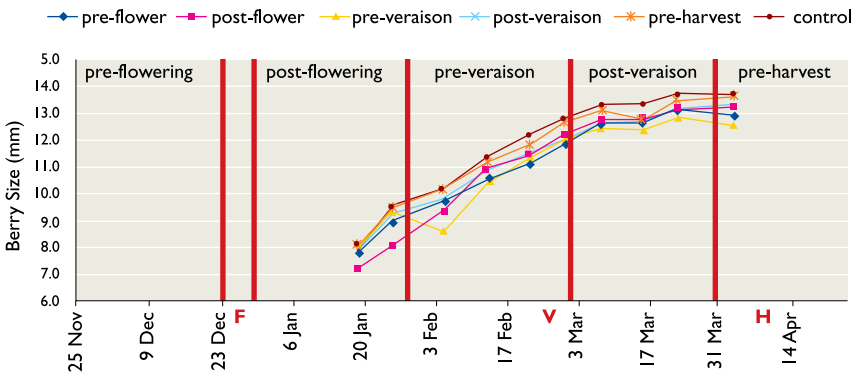

Figure 2: Berry size development for Sauvignon Blanc grape berries affected by irrigation treatments, where the vines were on a low water regime during the mentioned period, 2006-07.
F= flowering, V = veraison, H = harvest.

Table 1: Yield parameters for container-grown Sauvignon Blanc grapes under different irrigation scheduling, 2006-07, with S- and B-berry standing for small and big berries.

Treatment	Bunch #	Yield (g)	weight (g)	Bunch weight (g)	B-berry weight (g)	S-berry B-berry Brix	S-berry Brix
pre-flower	27	1666 bc	62.5 b	1.87	0.82	22.1 a	23.7 a
post-flower	27	1459 c	54.1 b	1.72	0.79	20.7 b	22.3 b
pre-veraison	26	1612 c	61.6 b	1.74	0.77	19.1 c	22.2 b
post-veraison	32	1956 b	63.5 b	1.92	0.77	18.5 c	20.7 c
pre-harvest	30	2334 a	76.7 a	1.92	0.80	21.3 ab	22.7 ab
control	33	2033 ab	64.6 b	1.84	0.72	21.1 ab	23.2 ab
Significance	ns	***	**	ns	ns	***	***
LSD 5%		367.0	12.2			1.338	1.368

ns = not significant at P<0.05; ** = significant at P<0.01; *** = significant at P<0.001. Values in a column followed by a different letter are significantly different at P<0.05. LSD = least significant difference P<0.05

Key funding sources and collaborating companies

- Foundation for Research, Science and Technology
- Riversun Nurseries

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Project: Rootstock evaluation for Sauvignon Blanc wine quality

Background

Most of New Zealand's vineyards are planted with Phylloxera-resistant rootstock so it is important to understand how these rootstocks are influenced by climate, soils and soil moisture and how, in turn, they influence yield and juice parameters and, ultimately, wine quality.

Two long-term trials on the Wairau Plains are evaluating the response of Sauvignon Blanc growing on a range of rootstocks. Both sites were planted in the early 1990s. Site One has been monitored for 10 years while Site Two is being evaluated for the first time this year.

Key results from this year

At Site One, rootstock had a significant effect on soluble solids at harvest, with grapes on 101-14 having a highest and Schwarzmann the lowest Brix respectively. There was no statistical difference in either pH or titratable acidity.

Table 1: Effect of rootstock on berry weight and juice composition of Sauvignon Blanc grapes at harvest, March 2007, at Site One.

Rootstock	Berry weight (g)	Brix	pH	TA
101-14	1.93 bc	21.39 a	3.041	10.47
SO4	1.82 c	20.20 bc	3.018	11.13
Schwarzmann	2.10 a	19.99 c	3.034	10.86
3309	2.00 ab	20.26 bc	3.071	10.20
125AA	2.05 ab	21.16 ab	3.031	10.74
P	0.003	0.018	ns	ns
LSD (5%)	0.1389	0.968	-	-

Means in the same column followed by the same letter are not significantly different (P > 0.05).

Table 2: Effect of rootstock on yields and yields components of Sauvignon Blanc grapes at harvest, March 2007, at Site One.

Rootstock	Yield vine (kg)	Average number of bunches	Average bunch weight (g)	Average berries per bunch	Number of bunches per bud	Yield per bud (g)
101-14	4.98 b	65.9	75.6 b	38.8	1.25	94.2 b
SO4	4.76 b	71.8	66.1 c	36.2	1.35	89.4 b
Schwarzmann	5.52 ab	67.6	81.6 ab	38.7	1.28	104.3 ab
3309	6.24 a	73.2	85.2 a	42.5	1.39	118.4 a
125AA	6.20 a	71.8	86.0 a	41.8	1.35	116.6 a
P	0.006	ns	<0.001	ns	ns	0.005
LSD (5%)	0.918	-	7.80		-	17.29

Means in the same column followed by the same letter are not significantly different (P > 0.05).

Table 3: Effect of rootstock on berry weight and juice composition of Sauvignon Blanc grapes at harvest, March 2007, at Site Two.

Rootstock	Berry weight (g)	Brix	pH	TA
101-14 bdx	1.98	20.00 d	3.053	10.34
101-14 stell	1.93	20.82 abcd	3.035	10.59
3306	2.05	20.33 cd	3.048	10.90
8 B	1.90	20.93 abcd	3.052	10.47
Gravesac	1.89	20.78 abcd	3.060	9.97
K51-32	1.89	21.27 abc	3.040	10.35
K51-40	1.83	21.63 a	3.058	9.74
Riparia gloire	1.90	21.45 ab	3.052	10.44
SO4 bdx	1.87	20.62 bcd	3.012	10.97
P	ns	0.029	ns	ns
LSD (5%)	-	0.956	-	-

Means in the same column followed by the same letter are not significantly different (P > 0.05).

Rootstock had no significant effect on bunch number or bunches per bud. However, vines grafted to 3309 and 125AA had significantly higher yield when compared to 101-14 and SO4, reflecting higher bunch weight predominantly caused by increased berry number per bunch. Vines grafted to Schwarzmann and SO4 produced the highest and lowest berry weight respectively, following trends observed in previous seasons.

At Site Two, rootstock caused small, but significant differences in soluble solids concentration, but no significant effects on vine yield other fruit parameters (Tables 3 and 4).

This season's results from Site One show previous trends continuing, in particular the higher and lower average berry weight when vines are grafted to Schwarztmann

Table 4: Effect of rootstock on yields and yields components of Sauvignon Blanc grapes at harvest, March 2007, at Site Two.

Rootstock	Yield vine (kg)	Average number of bunches	Average bunch weight (g)	Average berries per bunch	Number of bunches per bud	Yield per bud (g)
101-14 bdx	5.67	75.7	74.1	37.5	1.43	107.4
101-14 stell	5.48	75.1	73.0	37.8	1.44	104.9
3306	6.10	73.0	82.1	39.7	1.43	119.5
8 B	5.87	78.6	73.8	39.1	1.52	113.5
Gravesac	6.31	85.3	73.7	38.7	1.62	119.8
K51-32	6.38	81.8	78.1	41.0	1.57	122.2
K51-40	6.09	79.1	75.9	41.2	1.52	116.7
Riparia gloire	5.19	69.9	72.6	38.3	1.32	98.0
SO4 bdx	5.39	75.2	71.5	38.7	1.43	102.1
P	ns	ns	ns	ns	ns	ns
LSD (5%)	-	-	-	-	-	-

Means in the same column followed by the same letter are not significantly different (P > 0.05).

and SO4 respectively and lower yields when grafted to 101-14. The rootstocks used at Site Two show small, but in some cases significant, differences in fruit composition as a result of grafting to rootstocks not widely used in Marlborough. Research will continue for another season to confirm the consistency of these results.

Key funding source

- Marlborough Wine Research Centre

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Project: Influence of crop load on vine performance and fruit characteristics

Background

An important feature of all the trials in the Quality New Zealand Wines programme for the Foundation for Research Science and Technology has been the use of 2-cane and 4-cane pruned vines to establish differing yields within vineyard sites. This aims to eliminate the crop load factor when comparing yields and fruit quality between the different vineyards.

In order to assess the actual influence of the crop load on the fruit and vegetative growth characteristics, a separate crop load trial was incorporated into the intra-vineyard trial at Squire Estate during the 2005/2006 season. Vines were pruned to 20, 40, 60 or 80 nodes, on 2, 4, and 6-cane vines respectively.

Results in the 2005/2006 season had shown a mostly linear relationship between yield and yield parameters (bunches per vine, bunches per node, bunch weight, berry weight), but little effect was found on fruit quality as defined by soluble solids content (°Brix), pH and titratable acidity (TA). A strong negative relationship had been found between the number of nodes laid down and the number of blind buds and effective shoot vigour.

Because those preliminary findings warranted further investigation, a more controlled trial was set up at the Rowley Crescent vineyard during the 2006/2007 season to study the impact of crop load on vine development, yield and fruit quality as well as on over-wintering reserve status.

Key results from this year

There were five different pruning levels, for which 24, 36, 48, 60 and 72 nodes were laid down (24N, 36N, 48N, 60N and 72N respectively) with six replicates each, organised in three vine rows. Additionally 12 vines were pruned to 48 nodes but the




fruit was reduced at veraison for six vines to 24 bunches (48N/24) and for the other six to 36 bunches (48N/36) per vine.

Few differences were found in the timing of budbreak or other measurements of early development of the vine. Despite the big differences in number of nodes laid down, no differences were found in canopy density when measured by point quadrat at flowering time or at veraison. The numbers of inflorescences were very similar for all treatments except for 36N, which had 390 inflorescences, significantly more than the average of 280 for the other treatments.

At harvest, significant linear increases with node count were found for bunches/vine and yield (Table 1, R^2 = 0.99). Bunch weights were similar for all treatments. Bunches/node and berry weight both decreased linearly with node count (R^2 = 0.94 and 0.81 respectively), as did the soluble sugars (°Brix, R^2 = 0.86). A positive correlation was also found between nodes laid down and TA but no significant differences were found. There was a statistical difference between some of the treatments for pH but this difference was only between pH 3.03 for 24N and 3.08 for 36N and 48N.

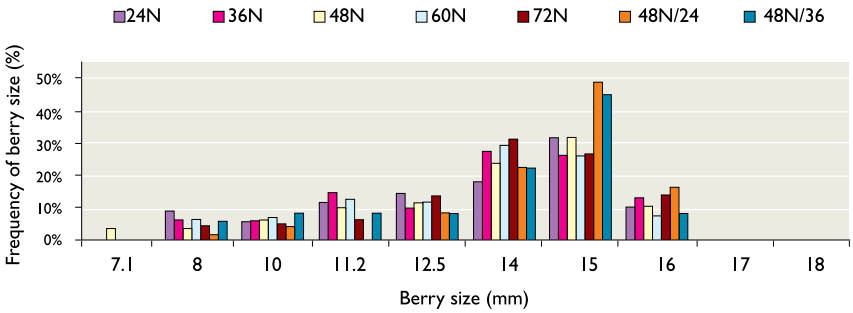

Figure 1: The frequency of Sauvignon Blanc grape berry sizes three weeks before harvest, from vines pruned to five different node numbers (24-72 nodes) with two sets of 48-node samples crop-thinned at veraison to 24 and 36 bunches per vine respectively, 2006-07.

The fruit-thinned vines obviously had severely reduced yields, but this was caused only by the lower numbers of bunches, as the weight/bunch was not significantly different from those from any other treatment. However, the fruit thinning did have a big influence on both the average berry size and the berry size distribution. When measured three weeks before harvest, for vines thinned to 24 bunches, the berry size was 10% greater than the size of the berries from any other treatment. Figure 1 shows a much higher frequency of big berries for the fruit-thinned vines, especially for those in the 48N/24 treatment.

All fruit samples were collected, but because of time restraints during harvest, all fruit for further analysis was frozen and will be assessed later in the season. The influence of crop load on bunch architecture, bunch weight distribution over the whole vine, and berry size and distribution will be further investigated, as will the availability of fruiting canes and carbohydrate reserves for the following season.

Table 1: Yield and fruit quality parameters for Sauvignon Blanc grapes grown on vines pruned to different node numbers (N), 2006-07.

Nodes	bunch /vine	yield/ vine (kg)	weight bunch (g)	bunch /node	Berry weight	°Brix	pH	TA
24N	48.4 d	4.74 e	98.26	2.0 a	2.3 a	21.5 a	3.03 b	8.71
36N	72.5 cd	7.22 d	99.62	2.0 ab	2.3 a	21.6 a	3.08 a	9.80
48N	91.6 bc	9.50 c	103.64	1.9 ab	2.2 ab	21.2 a	3.08 a	9.99
60N	108.5 ab	11.05 b	101.99	1.8 b	2.2 ab	20.6 b	3.05 ab	10.24
72N	127.0 a	12.66 a	99.94	1.8 b	2.1 b	19.8 c	3.04 ab	10.38
P	<0.001	<0.001	ns	0.049	0.04	<0.001	0.048	ns
LSD 5%	32.34	0.87		0.20	0.11	0.59	0.04	2.17

ns = not significant at P<0.05; <0.001 = significant at P<0.001; Values in a column followed by a different letter are significantly different at P<0.05. LSD = least significant difference P<0.05

Key funding source

- Foundation for Research Science and Technology

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Project: Sauvignon Blanc Regional Vineyard Evaluation

Background

Marlborough Sauvignon Blanc has a distinctive character, which makes it the benchmark style for this variety in the world. However, the soils and climate of the Marlborough region are not uniform, and sub-regional differences are observed. The extent to which these reflect the climate, soil and/or management differences within the region are not clear and a trial was established in August 2004 to grow grapes using a similar management protocol at each of five sites. We anticipated that yields may vary between the sites. To accommodate this, plots were either 2- or 4-cane pruned to give differences in yield and fruit to leaf area ratio. The trial, which has been in progress for three seasons, also demonstrates marked differences in temperature within the sub-regions in Marlborough and how that may influence vine development and composition of the fruit.

Table 2: Dates of key stages of phenological development for 4-cane pruned vines at the Squire trial site (North side of the Wairau Valley) over three seasons and corresponding growing degree days

	2004/2005	2005/2006	2006/2007
50% Budburst	7 Oct	30 Sept	1 Oct
50% Flowering	13 Dec	5 Dec	7 Dec
Flowering Duration	16 days	11 days	25 days
50% Veraison (8.4 °Brix)	27 Feb	4 Feb	14 Feb
Yield per vine	8.0 kg	4.9 kg	5.6 kg
Harvest date (21.7°Brix)	19 April	14 March	28 March
GDD – BB to Fl (Days)	296.5 (67)	252.5 (66)	255.2 (67)
GDD - Fl to V (Days)	543.6 (76)	471.7 (61)	425.0 (69)
GDD - V to H (Days)	235.0 (51)	238.1 (38)	295.4 (42)
GDD - Fl to H (Days)	778.6 (127)	709.8 (99)	720.4 (111)
GDD – BB to H (Days)	1075.1 (194)	962.3 (165)	975.6 (178)

Vines were monitored regularly during key developmental stages (bud break, BB; flowering, FL; veraison, V; and harvest H). The accumulated growing degree days and days taken to progress between these development stages (in brackets) are shown.

Climate

Seasonal accumulated growing degree days (GDD), using a base 10oC temperature have been traditionally used to compare the differences between sites and seasons (Table1). The Seaview site (Lower Awatere Valley) is consistently cooler than the other sites (all in the Wairau Valley). Marked differences are also observed between seasons.

Table 1: Growing degree day summary for the 2004/2005, 2005/2006 and 2006/2007 seasons

	Sept 04 – April 05	Sept 05 – April 06	Sept 06 – April 07
Blenheim	1239.9	1314.4	1219
Villa Maria	1215.6	1275.7	1211
Squire	1147.5	1198.5	1143
Oyster Bay	1136.4	1174.0	1107
Booker	1128.4	1162.9	1082
Seaview	1104.2	1148.2	1076

1LTA – Long Term Average growing degree day total for Blenheim 1947-2006 = 1199

While the seasonal accumulated GDD provides an overall summary, it does not take into account the stage of the season at which the warm and cold events occur. The timing of these events can have a marked influence on the development of the vine, particularly if warm or cold events coincide with key developmental stages of the vine (eg. flowering). For example, the cool spring in 2004 resulted in later bud-break (Table 2). The development of the vines was later throughout this growing season, resulting in a late harvest. While the number of days from bud-break to flowering varied little between seasons (on average 67 days at Squire and 69 at Booker), the time from flowering to veraison and to harvest was more variable between seasons, particularly at Squire, where yields were different between seasons. This suggests that vine yield may be having an important role in

Table 3: Dates of key stages of phenological development for 4-cane pruned vines at the Booker trial site (south side of Wairau Valley) over three seasons and corresponding growing degree days

	2004/2005	2005/2006	2006/2007
50% Budburst	5 Oct	28 Sept	9 Oct
50% Flowering	17 Dec	6 Dec	13 Dec
Flowering Duration	18 days	7 days	18 days
50% Veraison (8.4 °Brix)	25 Feb	31 Jan	17 Feb
Yield per vine	8.3 kg	7.7 kg	8.0 kg
Harvest date (21.7°Brix)	12 April	24 March	8 April
GDD – BB to Fl (Days)	302.3 (73)	247.2 (69)	239.4 (65)
GDD - Fl to V (Days)	529.5 (70)	438.2 (56)	414.7 (66)
GDD - V to H (Days)	225.4 (46)	308.9 (52)	320.7 (50)
GDD - Fl to H (Days)	754.9 (116)	747.1 (108)	735.4 (116)
GDD – BB to H (Days)	1057.2 (189)	994.3 (177)	974.8 (181)

determining the length of time required to reach ripeness.

Flowering

While the date of bud-break appears to largely control the date of flowering, the temperature at flowering controls the duration (Figures 1 and 2). This time taken for vines to progress through flowering potentially controls the uniformity of fruit composition at harvest. In the 2005 season, flowering began one to two weeks later than in the 2006 and 2007 seasons. The later start to flowering and cold weather in December 2004 led to a late harvest in 2005 (Figures 3 and 4). At the same time, the cool temperatures experience in December 2006 (2007 harvest), resulted in a prolonged flowering of 18 to 25 days at the Booker and Squire vineyards respectively, compared to 7 and 11 days in December 2005.

In general, 2-cane pruned vines flowered earlier than 4-cane, and particularly at the Squire Vineyard, these were reflected in the accumulation of soluble solids in the fruit and harvest dates.

Key results

Unlike the Squire trial site, the Booker trial site has a remarkably consistent yield between seasons; only 8% difference in yield between 2005 and 2006. There was only 19 days difference in harvest date between 2005 and 2006 (c.f. 36 days at Squire Estate), suggesting that soil type is having an important influence on vine development and consistency between season. Comparing the two vineyard sites suggests that weather conditions are having a relatively greater effect on vines growing on the stony Squire site when compared to the deep silt of the Booker vineyard and suggests that grapevines planted on heavier soil types have a much greater ability to mitigate the changes in climate from season to season. This data is providing an understanding of the differences that

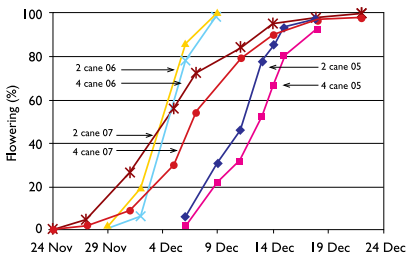

Figure 1: Flowering progression at Squire Vineyard over three seasons

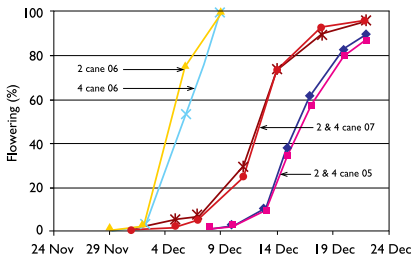

Figure 2: Flowering progression at Booker Vineyard over three seasons

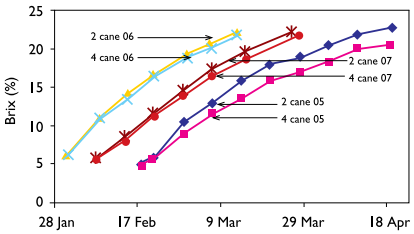

Figure 3: Maturity of the fruit at Squire Vineyard measured by Brix over three seasons

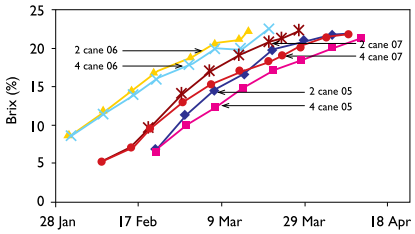

Figure 4: Maturity of the fruit at Booker Yineyard measured by Brix over three seasons




exist between the various sub-regions in Marlborough for all these parameters both within and between seasons and will be developed into management models to predict the consequences of seasonal changes in temperature on vine development, in particular harvest date. Summaries of all this data in the near future should help us to provide the background information necessary to explain the differences in the flavour and aroma characteristics that are being observed in the juice and wine.

Key funding sources and collaborating companies

- Foundation for Research Science and Technology
- Pernod Ricard New Zealand Ltd
- Villa Maria Estate Ltd
- Oyster Bay Wines New Zealand Ltd

Contact

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Project: Impact of rate and timing of post-flowering nitrogen applications on volatile thiols of Sauvignon Blanc

Background

Past studies have shown that nitrogen fertilization to vineyards can have big implications for vine physiology and wine quality but, to date, there have been few studies on the role of nitrogen in the Marlborough wine growing region. Historically vineyards have been established on the Wairau Plains on relatively fertile, alluvial soils requiring little nutrient supplement beyond that needed for vine establishment. However, annual nitrogen removal (estimated to be 19 to 30 kg N/ha per annum by a 10 tonne/ha crop) may result in increasing vine nitrogen deficiencies. Viticulturists need to be able to replace the seasonal nitrogen demand without causing excessive vegetative growth. This study investigates the impact of pre-bunch closure and veraison nitrogen additions on vine nitrogen status of *Vitis vinifera* L cv Sauvignon Blanc.

Nitrogen fertilizer was supplied by adding 0g, 100g and 200g dry urea under the drip-irrigation zone as a single or split addition, in January and/or February. Each treatment was repeated four times on two different soil types within a vineyard on the Wairau Plains. Leaf chlorophyll content on 16 tagged leaves of every plot was monitored periodically between pre-bunch closure and harvest using a Minolta SPAD-502 meter. Random berry samples were collected weekly for analysis of berry weight, brix, titratable acidity and yeast assimilable nitrogen (YAN). At harvest, total yields and bunch counts were determined.

Key results from this year

Nitrogen applied pre-bunch closure resulted in increased chlorophyll concentration, although the high nitrogen treatment also resulted in an increase of leaf senescence on shaded leaves in the fruiting zone. The nitrogen applications also resulted in higher YAN concentrations in the juice (484, 470 and 342 g/L following the application of 200g, 100g and 0g urea respectively), but a delay in sugar accumulation in the berries. Fruit has been harvested for microvinification and the influence of nitrogen addition on glutathione and volatile thiols (3MH, 3MHA) will be determined.

Key funding sources and collaborating companies

- Marlborough Wine Research Centre
- Tertiary Education Commission
- Cloudy Bay Winery

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Vine and fruit health

Vine and fruit health research at the Centre has three main objectives:

- to control and manage seasonal diseases, to ensure that fruit is sound and free of disease and chemical residues,
- to development management strategies to minimise losses to pests, including birds,
- to maximise vineyard longevity through the control of virus and wood-rotting diseases.

Project: Long term vineyard sustainability

Background

As the wine industry looks increasingly at the importance of sustainable production and the desirability of carbon-neutral production systems, vineyard management options are sought to help reduce carbon emissions and increase carbon sequestration.

Improved soil carbon management has a positive impact on soil quality, biodiversity, water infiltration and retention, as well as creating marketing opportunities, as illustrated by Grove Mill's advertising as the world's first carbon-zero wine company.

The objectives of this study are to:

- obtain a good understanding of actual impact of different forms of vineyard floor management on the vineyard carbon balance and its long-term effect on the economic sustainability of the vineyard
- determine how different vineyard floor management systems influence soil and vineyard health and their effect on vine productivity and wine quality
- determine soil quality indicators that can be incorporated into Sustainable Winegrowing score cards and monitoring systems
- determine how vineyard ecology can reduce pesticide use without affecting vine and grape health, thus saving production and environmental costs.

This project began in 2006, initially by examining the Sustainable Winegrowing scorecards to get an impression of the condition of vineyard soils and the changes in soil quality due to viticultural practices. Limited information was gained from the scorecards so the Sustainable Winegrowing Review (Outsourced Environmental), which became available in August 2006, was used as an indicator of the direction for this work.

Key results from this year

From the point of view of vineyard soil management, the Outsourced Environmental review drew the following conclusions:

- there is a need to make "the riches of a clean green land" more than an empty slogan. New Zealand must prove that its production methods are more sustainable than those of other countries
- there is a limitation in being able to effectively monitor environmental sustainability of the industry. Sustainable Wine New Zealand (SWNZ) needs to develop sustainability indicators
- after waste management, soil quality was indicated by SWNZ members as being the most important sustainability priority
- there is a need to establish the true state of the bio-physical environment and track changes/trends into the future.

An application, supported by New Zealand Winegrowers, to MAF's



Sustainable Farming Fund in February 2007 was rejected. However, following the recommendations of the Outsourced Environmental review, work was started on determining appropriate soil quality indicators to be used as future reference in the updated Sustainable Winegrowers scorecard. Soil carbon is one of the most important indicators which is also quite simple to investigate. Soil organic carbon, together with microbial biomass and basal respiration, give a good indication of soil health (microbial and macro biological life), soil structure (water holding capacity and infiltration), soil buffering capacity (for fertilizers and pesticides) and soil accessibility for roots and air. There is a large amount of underpinning research on carbon being carried out in the multi-CRI Sustainable Land Use Research Initiative (SLURI). An AGMARDT post-doctoral programme is linked to this, and is researching the impact of C on the buffering and filtering functions of soil – the soil's key ecosystem services.

For our work in viticulture, vineyards that combined several aspects are being sampled. Soil samples are investigated from vineyards of different ages on similar soils and management; also samples were taken from similar soils with different management. As suggested in the review, this research creates an opportunity to establish a base line for sustainability indicators like CO_2 emissions, carbon sequestration and soil respiratory quotient.

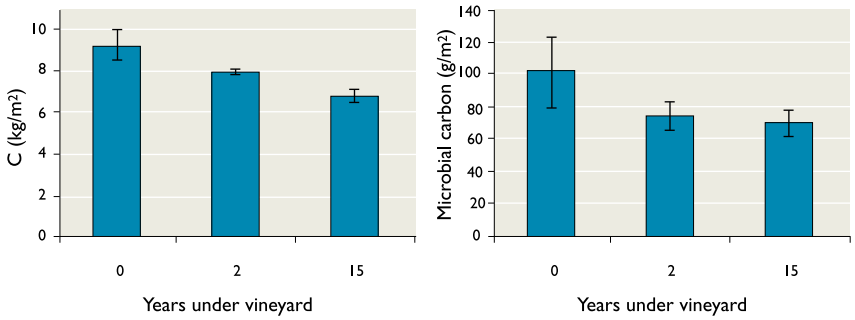

Figure 1: Organic C in the top 15 cm reduces over time but microbial activity only reduces initially but stabilizes after a few years.

Initial results show that, although soil carbon was lower in older vineyards, microbial activity (the main driver in the organic soil system) only decreased for a few years and stabilized after that (Figure 1).

When comparing organic to conventional vineyard management the data suggests that within two years after changing from organic to conventional management that soil organic matter is reduced from 5.5% to pre-organic management levels of 3%. This shows that carbon can be lost from the soil very rapidly. However soils of the old mulch trial at Stoneleigh showed that seven years after application, mulch still has a positive effect on soil carbon (Figure 2: 7.5% organic matter against 5% for non-mulched soil). In similar research done in orchards it was found that there is a potential to fix an extra 20 tonne of C per ha in orchards when appropriate soil management was used. Similar benefits could be obtained in vineyards. Besides C sequestration (which reduces atmospheric CO_2), increased soil C will improve water infiltration, water holding capacity, improve buffering against vineyard chemicals and nitrogen leaching, improve soil aeration and hence root growth.

The soil testing work is being continued in June 2007 and more soil carbon data from different soil/vineyard series will become available from this work. Based on the outcomes of this first year, further research in this area will be considered for the future.

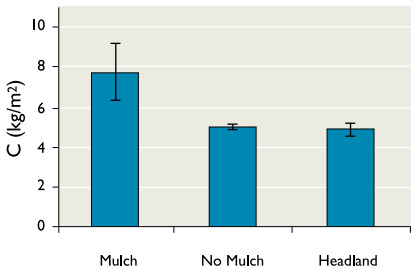

Figure 2: Soil C in top 15cm of soil in a conventional vineyard, that had mulch applied in 2000, no mulch and headland

Key funding source and collaborating companies

- Marlborough Research Centre
- Sustainable Land Use Research Initiative

Contact

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Project: Virus effects on Sauvignon Blanc wine quality

Background

Little has been previously reported on the impacts of Grapevine Leaf Roll Virus type 3 (GLRaV-3) on white grapes. HortResearch is not aware of any published studies measuring its impact on Marlborough Sauvignon Blanc in particular.

Key results from this year

In the 2005/06 season, this project began measuring the impact of GLRaV-3 on the leaves and fruit of 20 vines with, and 20 vines without, this virus. In 2006/07 the investigation was extended to a comparison of several vine/berry parameters at harvest on 80 vines, of which approximately half were known to be infected with GLRaV-3. Significant differences in berry weights, bunch number, pH, titrated acidity (TA) and juice ammonium content were observed at harvest 2007. Overall yield per vine was not affected by virus status. There was a tendency for infected vines to show a greater range of values for the variables that were measured. The possible implications of these observations are compared and contrasted with the results from the 2005/2006 season and from published papers dealing with the impacts of GLRaV-3 on three white varieties.

The main recommendation from the report is to monitor the vines for a third season, and to make and assess wine from grapes with, and without, virus. With two years of observations of differences in berry weights and juice ammonium content, as well as the large variation in juice composition reported in 2007 between individual vines with GLRaV-3, the research team predicts significant differences in wines made from vines with, and without, virus.

This project will be extended to allow the results to be written up as scientific papers.

Key funding source

- New Zealand Winegrowers

Contact

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Project: Investigation of grapevine trunk fungi in Marlborough

Background

Long term sustainability of wine grape production in Marlborough will depend on the longevity of existing vines. Most vines in the region are still relatively young but work is underway on the older vines to identify the fungi associated with vine decay. The main trunk fungi associated with three vineyards in Marlborough have been identified as *Botryosphaeria* and *Eutypa.* A range of sites are being monitored to check the progress of the disease and to investigate its effect on vine performance.

Trunk diseases can affect the composition of fruit by reducing soluble solids and berry nitrogen content. This has the potential to create loss for growers even before the losses caused by the eventual death of the vine as a result of the disease. The industry needs

more information to actively manage trunk diseases under New Zealand conditions.

The objectives of this project are to:

- determine the impact on vineyard productivity and fruit quality
- increase understanding of the economic impact of trunk disease.

Key results

Samples from adjacent symptomatic and non-symptomatic vines were taken at three sites, two Riesling and one Sauvignon Blanc. The same vines sampled for the presence of fungi were also monitored for vine performance during the 2006/2007 vintage.

Originally the vines were to be sampled at harvest only, and fruit composition and yield measured. However, Cristina Cocchi from the University of Bologna, as part of her eight-week internship with HortResearch in Marlborough, conducted an intensive pre-harvest sampling programme as well as the harvest assessment.

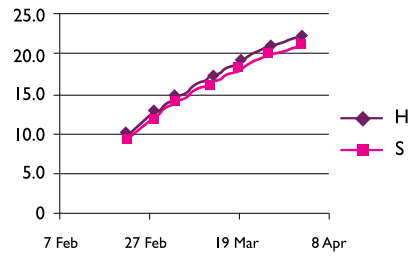
Table 1: A summary of the number of fungi isolated (in 2006) and identified from each of the five main pathogenic groups associated with grapevine trunk diseases. Before isolation, vines had been grouped into vines with visual symptoms (Sick) and vines without visual symptoms (Healthy).

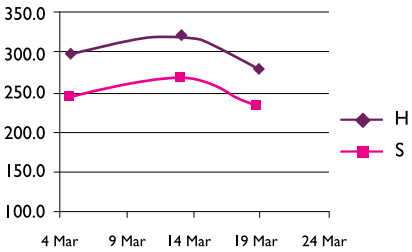
		Botryosphaeria	Cylindrocarpon	Eutypa	Phomposis	Basidiomycete
Site 1	Riesling					
	Sick (n=5)	5				
	Healthy (n=5)	3				1
Site 2	Riesling					
	Sick (n=10)	3		4		1
	Healthy (n=10)	2				
Site 3	Sauvignon Blanc					
	Sick (n=10)	3		5	2	2
	Healthy (n=10)	5	2	2	3	1

When cores of wood from vines were plated, some cores resulted in multiple fungal isolations from the same vine and other cores did not give rise to any isolates.

Botryosphaeria spp were isolated from all three sites from both vines with visual symptoms (Sick) and vines without visual symptoms (Healthy). At Site 1 all of the sick vines had *Botryospaeria spp*. isolated from them but so did three of the five healthy vines. These isolations were particularly interesting as the wine company had considered that they had a problem with *Eutypa lata* at this site, which was not isolated from these samples. *Eutypa* sp. was isolated from sick vines at the other two sites (2 and 3) as well as from healthy vines at Site 3. *Basidiomycete* fungi were isolated from all three sites and *Phomposis spp*. was isolated from both sick and healthy vines at Site 3. No simple pattern linking symptoms and isolations was observed.

Differences in mean soluble solids at harvest at all three sites were small. Fruit from healthy vines at Site 3 (Figure 1) had consistently higher mean soluble solid values than unhealthy vines.





Figures 1 & 2: Soluble solids (°Brix) and total yeast available nitrogen (YAN) values for Sauvignon Blanc vines with (S) and without (H) grapevine trunk disease symptoms at Site 3, 2007.

Miscellaneous

At Site 3 consistent differences in total yeast available nitrogen (YAN) was observed (Figure 2). The vines that had been selected as healthy (H) had higher amino acid levels than those which appeared sick (S) giving rise to higher yeast available nitrogen.

Both *Botryosphaeria* and *Eutypa* fungi are confirmed as present in the vineyards of Marlborough.

Key funding sources and collaborating companies

- Marlborough Research Centre
- MAF Sustainable Farming Fund
- Pacific Rim Oenology
- Horticultural Advancement Trust

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Project: Falcons for grapes

Background

The Falcons for Grapes project is attempting to establish resident native New Zealand falcons within Marlborough's vineyard region as a means of bird control. This is the second season of the project.

Key results this year

The project team, supported by volunteers, has found signs of falcons at 36 sites this year. The wet spring and extra growth has helped the prey of the falcons and surveys show better nesting rates and brood sizes than last year. Artificial nests have been put up in some of the vulnerable sites and automatic digital cameras triggered by an infra-red beam are being used to document the number of times the parents visit the nest, to identify the prey they are bringing and to identify any predators visiting the nest.

Two young male and two young female falcons were put out into the vineyards in December 2005. They are fed and radio-tracked daily and have settled down well, establishing home ranges of about 2km radius around the release sites. One of the females was killed by a feral cat in mid-winter but the others are doing well.

Fifteen chicks were fostered out during

December and January. The first year survival rate in the vineyards in 2005-6 was 75% - far higher than in the hills where only 25% survived.

So far in 2007, six of the 15 youngsters have been killed. One male was taken by a harrier just as it was learning to fly, another male was found injured in Renwick and died later. Four juvenile females have been electrocuted. The power lines in Marlborough are all live and extremely hazardous to birds. Two other juveniles have disappeared; probably their transmitters have failed or they have entered the hills. There have been no mortality signals from them.



Analysis of Falcon Nest Surveys 2005-7.

Analysis	2005/6		2006/7	
No sign	12	21.4%	8	17.70%
Undetermined	4	7.1%	1	2.20%
Occupied	40	71.4%	36	80%
Total sites checked	56		45	
Fledged successfully	10	25%	13	36.10%
Failed	8	20%	11	30.50%
Unknown (probably not breeding)	22	55%	12	33.30%
Female chicks	13	68.40%	7	22.60%
Male chicks	3	15.80%	8	25.80%
Unsexed chicks	3	15.80%	16	51.60%
Sex ratio F:M	4.3:1			0.87:1
Brood sizes (all)				
Single chick	3		1	
Two chicks	5		3	
Three chicks	2		8	
Unknown	2		1	
Mean fledged brood size	1.9	chicks	2.58	
Mean production for occupied sites	0.425	chicks	0.861	

The next phase of work in the vineyards entails mapping the movements of the falcons in detail. GPS backpack data loggers, weighing 5 gm, have been developed so that the position of a falcon may be logged within one metre, every two minutes for two to three weeks. This will make it possible to analyse when and where a falcon is hunting in the vineyards, and to match falcon presence against bird damage. So far, GPS backpacks have been used on two falcons.

It has become clear that the diminishing number of trees in the region is limiting the survival rates of the falcons. As more and more trees are felled for vineyards, the only perches left are power poles which are unsafe for wildlife, especially the larger female falcons.

Key funding sources and collaborating companies

- International Wildlife Consultants Ltd, UK
- Marlborough Wine Research Centre
- New Zealand Winegrowers
- MAF Sustainable Farming Fund
- Wither Hills Vineyards Marlborough Ltd

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Project: Vinefax information services

Background

The Vinefax service has operated in Marlborough since 1997 as a means of keeping in touch with what is happening in the district's vineyards and for accessing up-to-date information on the spread of disease. Vinefax operates as a weekly fax/email service from October until after the main harvest period has finished in April. It provides details of the previous week's growing degree days and rainfall from 14 weather stations in the Wairau, Waihopai and Awatere valleys. Details and dates of any *Botrytis cinerea* infection periods are also given. Four company vineyards supply details of powdery mildew and botrytis disease incidence from monitored vineyards allowing Vinefax to alert growers when disease development is taking place on well-managed vineyards.

Vinefax helps educate subscribers in aspects of disease monitoring and management and helps growers make informed choices about spray applications based on knowledge of the weather and disease development during the season. Vinefax supports the Sustainable Winegrowing New Zealand (SWNZ) programme and encourages subscribers to follow SWNZ practices.

Key results from this year

In response to feedback from subscribers, the Vinefax service began one month earlier in the 2006/2007 season than in previous years. Between 19 October, 2006, and 26 April, 2007, 28 weekly issues were sent out. This year was unprecedented in that only one supplementary issue had to be sent out in response to a *Botrytis cinerea* infection period at a susceptible stage of vine growth.

Vinefax also keeps subscribers informed about phenological development of the grapes as the season progresses. The current season is contrasted with previous years in order to give subscribers an idea of how different seasons compare.

Table 1: VineWatch summary for the week 19/04/07 to 25/04/07.

Location	Weekly Rainfall (mm)	Total Rainfall (mm)	Rain as % of Blenheim	Weekly GDD	Total GDD	GDD as % of Blenheim
Awatere – Redwood Pass Rd	0.6	431.4	118.5	17.5	1298	97.0
Awatere – Dashwood	0	295.8	81.3	15.4	1216.9	90.9
Awatere – Seaview	0.5	416.5	114.4	16.3	1241.1	92.7
Awatere – Tohu	1.4	455.6	125.2	13.6	1175.5	87.8
Rarangi	0	465.8	128.0	18.7	1247.5	93.2
Blenheim	0.1	364		17.8	1338.3	
Brancott	0	381.6	104.8	17.1	1243.8	92.9
Woodbourne	0.2	463.2	127.3	18.4	1294.6	96.7
Matthews Lane	0	426.4	117.1	18.4	1324.6	99.0
Stoneleigh	0	468	128.6	17.3	1280.5	95.7
Pauls Road	0.1	581.1	159.6	19.3	1307.8	97.7
Oyster Bay	0	653.3	179.5	19.7	1352.6	101.1
Waihopai Bridge	0	516	141.8	18.8	1308.2	97.8
Waihopai Valley	0.2	382.4	105.1	19	1305.9	97.6

GDD = growing degree days above a base of 10°C
Total Rain and Total GDD are taken from 1 July 2006

Table 1: The final Vinefax summary for the season, issued 27 April 2007. This table is included in Vinefax each week, summarizing rainfall and growing degree days of the previous week alongside the totals since the beginning of the season.

Key Funding sources and collaborating companies

- Vinefax is a subscriber-based service with an annual subscription of $325.
- There were 57 subscriptions in 2006/2007 with Vinefax reaching 110 people each week.
- Pernod Ricard and Cloudy Bay pay the phone line rentals to the weather stations on their properties and contribute to the operation and maintenance of the weather stations.

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Project: Focus Vineyard Marlborough

Background

This year was the culmination of a three-year project to encourage sustainable techniques within the rapidly growing wine industry. The project aimed to contribute to the industry's efforts to integrate production issues with the environmental requirements of the regulators.

Three growers with multiple varietals were selected although the project focused on one block of Sauvignon Blanc at each site.

The objectives of the Focus Vineyard project were:

- to examine vine growth responses against soil characteristics and nutrient values
- to move imposed current disease management programme to best practice methods
- to make best use of water resources, balancing the sustainability of those resources with the production of high quality end products
- to measure grape yield responses under current management practices
- to show how an understanding of factors affecting yield can improve vineyard knowledge and practices.

Each vineyard block was closely monitored for various production aspects; yield assessment, soil and vine nutrients, soil moisture and pest and disease levels.

During the course of the project, using seasonal management as a focus for vine management, a series of workshops and field days were held to provide information for growers.

Key results

Soil nutrient values measured annually included soils, petiole, blade, wood and juice. Results were generally within the optimal range required for grape production but values did vary within the vineyard sites.

The impact of rainfall, temperature, soil type, and root-stock variety influenced the concentrations of nutrient values in grape vines .The subsequent impact on wine quality has yet to be identified and future research will yield more information.

The project integrated the use of insect and disease monitoring with knowledge of pest biology and behaviour to alert growers early to potential problems. Scouts inspected a representative sample of the




vineyards for the presence of insects and disease. Information on beneficial insect activity, growth stage and any other relevant observation was also recorded. After each inspection, reports to growers relayed accurate information about the identity, location on the vine and severity of insects and diseases present. Growers were then able to take appropriate control measures.

The project found that reducing irrigation in a managed fashion, especially on light soil types (sandy to gravely loam) reduced yields. On higher soil moisture holding soils (silt loam) this reduction needed to be significant before a reduction in yield would occur. Increases in Brix and reduction in T/A was also likely to occur if irrigation reductions were significant.

Accuracy of grape yield forecasting continued to be a problem. Different methods of assessing yield were trialled in this study. The Forecaster model, used by some major wineries, was tested in the first two years. It required considerable effort to collect data at various growing stages through the season and, in some cases, the predicted yield had a standard deviation that was too large for practical use. Consistency in data collection is paramount for yield assessment. However it was proven that two field workers produced quite different yield predictions using the same model. During the course of the project it became clear that discrepancies in the type of data recorded within the industry needs to be resolved before attempting to accurately assess yield.

The findings from this project have been delivered to grape growers and the wider industry in a series of field days.

A report will be published with the results of the three years field work on the three Focus Marlborough Vineyards, results will cover vine nutrient use, water use, yield assessment and pest and disease management, and providing guidelines for best practice.

Key funding sources

- MAF Sustainable Farming Fund
- New Zealand Winegrowers
- Marlborough Winegrowers
- Marlborough Research Centre Trust
- Marlborough Wine Research Institute
- Sustainable Winegrowers New Zealand
- Netafim
- FruitFed Supplies
- Ravensdown Fertiliser Co-op Ltd
- Hills Laboratory
- HortResearch

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Project: Marlborough Meteorological Services

Background

This is a long-term project, funded annually, whereby the Marlborough Research Centre provides an essential service to the local community.

The objectives of the project are:

- to continue the operation of the official HortResearch regional weather station for Blenheim
- to maintain a database of meteorological information and disseminate for community and scientific use
- to give access to the weather station at Grovetown Park for educational groups.

A network of six HortResearch and two Marlborough Wine Research Centre vineyard weather stations is maintained under this project, collecting and summarizing information for research staff and clients.

Key results from this year

This year, access to all data from the Blenheim and Awatere/Dashwood weather

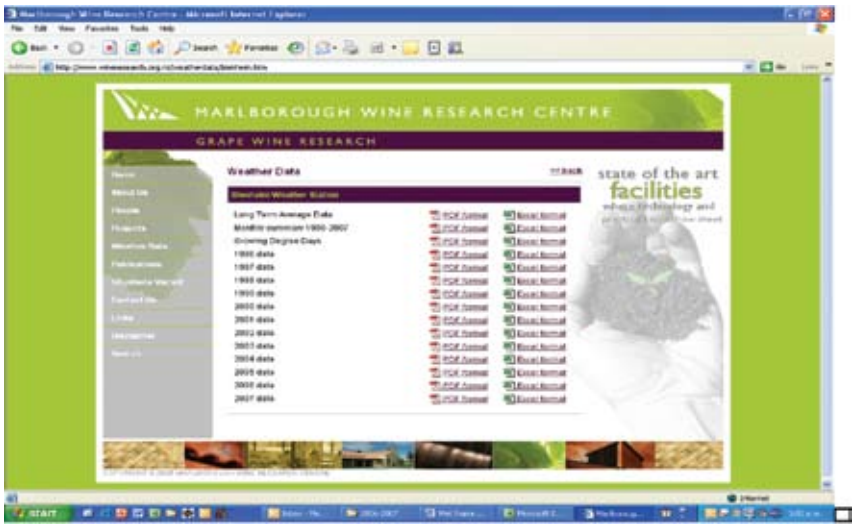

Figure 1: Blenheim weather data as displayed on the Marlborough Wine Research Centre website

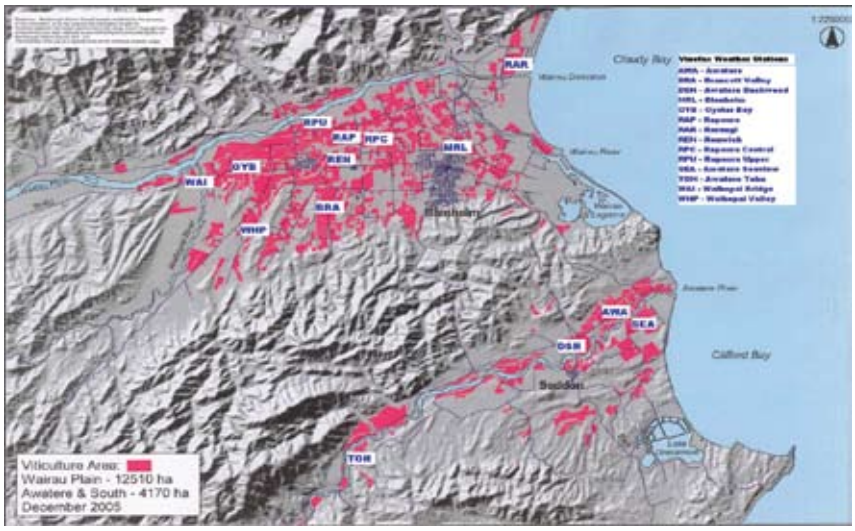

Figure 2: Location of 14 Marlborough weather stations used as part of the Vinefax service

stations has been improved by making it available on the Marlborough Wine Research Centre website. All daily data is summarized on a monthly basis and grouped by year, with data covering the last 21 years.

Six weather stations (Figure 2) located on the central Wairau Plains are owned by HortResearch (MRL, BRA, REN, RAP, RPC, RPU) and two in the Awatere valley are owned by the Marlborough Wine Research Centre (SEA, TOH). The ongoing maintenance and operation of these eight weather stations is carried out by Rob Agnew and funded by the MWRC. Another six private weather stations (RAR, WHP, OYB, WAI, AWA, DSH) are accessed in agreement with owners and data from these stations summarized as part of the Vinefax service.

Key funding sources

- Marlborough Research Centre
- HortResearch
- Pernod Ricard New Zealand Limited
- Cloudy Bay Vineyards

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Project: Soils analysis in the Starborough-Flaxbourne district

Background

Seventeen soil descriptions are located within the catchments of the Starborough Flaxbourne District. Three properties were selected; Dashwood, Flaxbourne Hills and Hurunui Hills which between them contain a cross-section of 80% of all soil types found in the district.

The objectives of this project are to complete and report on three property soil assessments, identifying physical attributes that constrain options for future management policies. The identity of each physical and mechanical soil structure,

nutrient characteristics, and their landscape relationships are under investigation. Soil nutrient values have been measured within three separate landscape environments; flat land, easy hill and steep hill. Soils nutrient values were sampled at 150 mm and at 500-650mm, to determine what future constraints on plants or pasture may be necessary under future development.

Information from this project can sit alongside farm management systems when landowners are considering the limits on soil capacities and the consequences of exceeding those limits.

This project will be completed in June, 2008.

Key results

- clay soil environments generally provide the greatest impediment to pastoral systems. When 15% or more of the clay adsorption sites normally occupied by calcium etc. are replaced with sodium (sodium-clay), the resulting poor physical condition of the soil restricts root growth and makes tillage difficult

- present nutrient values at a sample depth of 150 mm are favourable for hill country pastoral farming activities

- soils at deeper sample depths generally appeared overly-saturated with magnesium, sodium pH and calcium, and are outside the optimal range for hill country pastoral activities

- erosion is severe in some areas due to a combination of factors, including rainfall level and intensity, soil texture, slope gradient, ground cover, land use and the impact of sodium on the erodibility of clays.

- dry northerly aspects of more than 15 degrees are more prone to soil erosion. On such sites, soil with low water permeability and slow infiltration may cause ponding then crusting when dry (sheet erosion). These conditions inhibit seedling emergence and plant growth. These soils are prone to swelling and shrinkage during periods of wetting and drying, further breaking down soil structures (wind erosion).

Key funding sources and collaborating companies

- MAF Sustainable Farming Fund
- Marlborough District Council
- NIWA
- Power Trust
- New Zealand Landcare Trust
- Ravensdown Fertiliser Co-op Ltd
- Marlborough Research Centre

Contact

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Project: The evaluation and demonstration of annual clovers on Marlborough hill country

Background

Approximately 480,000 hectares of the classified Marlborough Hill country environment are under clover *Danthonia spp*. An increased return of 10% to 15% from this pasture would have a significant impact on Marlborough's pastoral economy.

The project is investigating various farm management and animal grazing systems to ensure the annual legume seed strike and their agronomic values are successful.

The objectives of this project are to:

- identify annual clover establishment responses from small plot design into a



whole farm environment

- demonstrate 'best practice' clover establishment, management and animal grazing systems, to ensure successful seed strike in the first autumn, flowering in spring and subsequent seed set
- identify a range of annual clovers and measure their sustainability under a wide range of farm management systems and practices
- improve agronomic knowledge and thus encourage farmers to adopt annual clovers into whole farm systems.

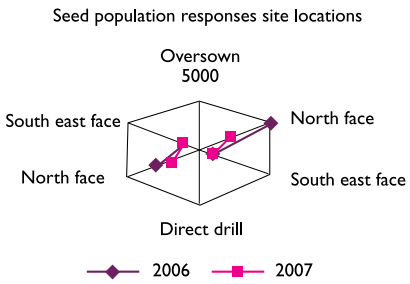

Table 1: Annual clover seed population responses site locations.

Four farm sites have been established and a site at the top of Weld Pass set up for small plot demonstrations. A 10-ha hill country site was direct-drilled with a range of annual clovers to identify establishment and plant population persistence under normal farming practices. The Weld Pass site was sown with a range of new annual clovers in autumn 2007.

Key results from this year

There was a decline in annual seed populations on the on-farm sites sown in 2005 and in results leading up to seed set 2007, which may have been due to competition from resident pasture species. Also, cool 2006 spring temperatures and low rainfall causing drought conditions may have contributed to poor seed set and stock over-grazing.

Table 1 shows the comparison between over-sown/direct drill of 56.25% and 35.425 decline in seed populations respectively on north-face site treatments. The same treatments saw 7.14% and 6.20% increases in seed populations on south-face sites.

Results to date suggest:

- The most common resident annual clover cultivar (cv) is Mt Barker but productivity is limited by low plant populations. Early onset of summer droughts and the medium/late flowering of Mt Barker contributes significantly to low plant populations.
- Woogenella cv is best on the driest sites.
- A mixture of Woogenella and softer seed varieties, such as Dalkeith or Seaton Park, may be preferred due to earlier flowering abilities.

The project is due for completion in 2009.

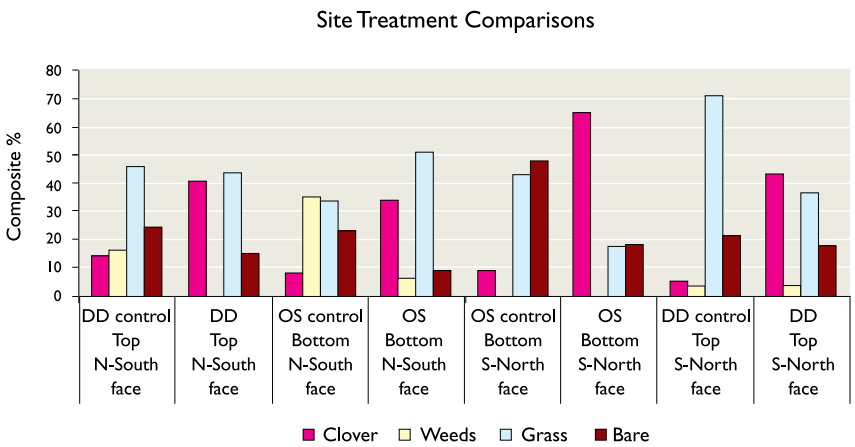

Table 2: Annual clover composite comparisons for site treatments.

Key funding sources

- Marlborough Research Centre Trust
- MeatWool NZ
- Lincoln University
- Argyle Trust
- Cummins Trust

Contact

rhunter@hortresearch.co.nz

Project: The evaluation of drought-tolerant forage species for Marlborough hill country pastoral environment

Background

Marlborough pastoral farmers need a drought-tolerant forage species that will ease their traditional reliance on ryegrass and clover. The forage and erosion control plant, Immigrant Schrad (*Kochia prostrate)*, was selected for trial.

Taken into the United States from the Stravopol Botanical Gardens, USSR, 40 years ago, it was released by the US Forest Service Shrub Sciences Laboratory as a forage and erosion control plant for the western rangelands of Wyoming in 1984.

Forage *Kochia* produces succulent branched stems annually. It has shown superior performing accession in experimental seedling trials, rangeland seedlings and on eroded areas in Utah, Nevada, Arizona, New Mexico and Wyoming. It has demonstrated superiority in longevity and competitiveness with annuals. Individual plants can live 10 to 15 years and it readily reseeds. It develops a fibrous root system with a large, deep tap root. A perennial semi-evergreen sub-shrub growing from 30mm to 100mm, it can be used for year-round grazing.

The objectives of this project are to

- investigate the establishment of *Kochia prostrate* using small plot practices that will determine optimal productivity, composition, quality and persistence, reproductive responses, nutrient requirement and economic benefit
- identify best management practices for species response and persistence, and measure against animal performance throughout the year.

Key results from this year

The first year of this project, investigating importation requirements to introduce this plant species into New Zealand, was completed with significant difficulty in meeting the requirements of the agencies responsible for New Zealand's bio-security regulations.

Two species, *Kochia prostrata* and *Trifolium glanduliferum*, have now been released. However, the bacterium required for inoculation and sow seed treatments was not released in time for autumn 2007 sowings.

The project has provided "core practise" opportunities for HortResearch (Class3) quarantine facilities in Marlborough.

Key funding source and collaborating companies

- Marlborough Research Centre Trust
- Kiwi Seeds Marlborough
- ERMA
- MAF Bio-Security
- HortResearch

Contact

rhunter@hortresearch.co.nz

PROJECT	STAFF	PAGE
Marlborough Meteorological Services	• Rob Agnew, Victoria Raw *HortResearch Marlborough*	55
Soils analysis in the Starborough-Flaxbourne district	• Don Ross *CEO Landcare Trust, Christchurch* • Doug and Fraser Avery *Farmers, Seddon* • Richard Hunter *RMH & Associates, Blenheim* • *Starborough Flaxbourne Soil Conservation Group* • Barrie Wills *Environmental Services, Alexander* • Graeme Ogle *Farm Advisory Consultant* • Gavin Kenny *NIWA, Wellington* • Paul Millen *Landscape Consultant, Blenheim* • Nicky Eade *Marlborough District Council* • Barbara Stuart *Landcare Trust, Nelson*	56
The evaluation and demonstration of annual clovers on Marlborough hill country	• Richard Hunter *RMH & Associates* • Dick Lucas *Senior Lecturer (Agronomy) Lincoln University* • Tony Whatman *Farm Advisory Services, Lincoln University* • Tony Turnbull *Farmer, Redwood Pass, Marlborough* • Chris Dawkin *Marlborough Monitor Farm Committee*	57
The evaluation of drought-tolerant forage species for Marlborough hill country pastoral environment	• Richard Hunter *RMH & Associates* • *Marlborough Research Centre project leader* • Bruce Clark *Kiwi Seeds, Marlborough*	59

Marlborough Research Centre of Excellence Trust

Annual Report for the Year Ended 30 June 2007

CONTENTS

Marlborough Research Centre of Excellence Trust

Directory as at 30 June 2007

DIRECTORY

Trustees	John Marris, Chairman Edwin Pitts Bernie Rowe
Executive Officer	Gerald Hope
Nature of Business	Administration of research projects
Location	85 Budge Street Blenheim
Auditors	Angela Wood Chartered Accountant P O Box 777 Blenheim
Solicitors	Gascoigne Wicks P O Box 2 Blenheim
Bankers	Bank of New Zealand 92-94 Market Street Blenheim

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Research Operating Accounts - for the year ended 30 June 2007

	Sauvignon Blanc research projects	Wine industry research projects	New Zealand Winegrower's projects	TOTAL	Last Year
Revenues					
Contract research revenues	448,758			448,758	493,603
Wine industry contributions (note 15)		294,689		294,689	308,624
New Zealand Winegrowers			56,903	56,903	21,277
Vinefax subscription		25,928		25,928	23,564
Other revenues			12,600	12,600	16,290
MRC Trust research grants	154,836			154,836	65,000
Gross Income	603,594	320,617	69,503	993,714	928,357
Costs					
Personnel	166,087	68,332	50,094	284,513	200,465
Consumables and direct research costs	31,640	6,325	17,058	55,022	42,823
Vinefax cost		20,221		20,221	50,000
Subcontracting	271,632	76,588	10,000	358,220	243,987
Research Centre charges (note 16)	78,916	60,139	36,061	175,116	375,916
Depreciation	5,244	2,088		7,332	
Other Costs	46,010	35,062	21,025	102,097	14,010
	599,528	268,756	134,237	1,002,521	927,202
Net Surplus (Deficit)	**4,066**	**51,861**	**(64,734)**	**(8,807)**	**1,156**

Research Centre Operations - for the year ended 30 June 2007

Revenues				
Surplus (deficit) on Research accounts			(8,807)	1,156
Rentals			46,825	51,735
			38,018	52,891
Costs				
Personnel		115,132		124,453
Office expenses (note 10)		10,526		42,754
Administration costs (note 10)		33,003		24,863
Operating costs (note 10)		28,115		95,639
Rates and insurance		6,797		1,607
Tenant recoveries		(2,081)		
Depreciation		129,466		135,347
		320,958		424,663
less - recovered from research projects and operating accounts		(175,116)		(510,637)
			145,842	(85,974)
Net surplus (deficit) from operations - transferred to Trust account			**(107,823)**	**138,865**

NOTE: This Statement is to be read in conjunction with the Notes to the Financial Statements

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Rowley Vineyard operations

			Last year
Revenue			
Grape Sales		189,931	221,903
Rent - NZ Vine Improvement Group		10,750	10,750
		200,681	232,653
Costs			
Vineyard Personnel costs	33,341		41,314
Vineyard Operating costs	10,642		13,324
Vineyard Administration	1,636		87,323
Vineyard Rates and insurance	4,624		3,980
Vineyard Depreciation	11,903		14,040
		62,147	159,982
Net vineyard surplus		**138,534**	**72,672**

Grovetown Park account

Revenue			
Rentals		89,129	90,342
Costs			
Repairs and maintenance	2,351		8,557
Transfer to maintenance provision	2,000		2,000
Other expenses	179		(1,598)
Tenant recoveries	(4,535)		
Depreciation	7,330		7,356
		7,326	16,315
Net Grovetown Park surplus		**81,803**	**74,027**

Trust Revenue and Expenditure Accounts - for the year ended 30 June 2007

Revenue			
Interest Received		74,538	61,935
Theatre Hire/Data Projector Hire		3,192	1,045
Marlborough District Council		110,000	110,000
Liquorland Scholarship		6,185	
Net vineyard surplus		138,627	72,672
Net Grovetown Park surplus		81,803	74,027
Net Surplus on Research Centre operations		(107,823)	138,865
		306,429	458,543
Costs			
Audit fees	2,675		4,500
Grant - RMH & Associates	45,000		35,000
Grant - Hort Research Research Grants	15,000		50,000
Grant - Wine Research Centre research grants	154,836		65,000
Other grants	2,546		20,100
Other costs			51,501
		220,057	226,101
Marlborough Research Centre of Excellence Surplus - transferred to capital		**86,372**	**232,442**

NOTE: This Statement is to be read in conjunction with the Notes to the Financial Statements

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Statement of financial position as at 30 June 2007

				Last year
Current Assets				
BNZ current account number 2		9,547		7,554
Goods & Services Tax refund due		14,022		2,116
Interest accrued		23,716		16,458
Work-in-Progress		15,615		
Accounts receivable		126,776		327,996
	Total current assets		189,677	354,124
Investments				
BNZ Term Deposit (note 3)			1,389,064	844,787
Fixed assets				
Opening Book Value		2,817,051		2,880,743
Additions this year (note 4)		48,657		93,051
Depreciation written off		(148,699)		(156,743)
Balance at year end (note 4)			2,717,009	2,817,051
	Total non-current assets		4,106,073	3,661,838
	Total assets		4,295,749	4,015,962
Current liabilities				
BNZ current account		112,756		132,859
Accounts payable (note 11)		251,465		34,946
Wine industry advance contributions (note 7)		114,000		119,001
			478,220	286,805
	Net assets		3,817,529	3,729,157
Equity (note 8)				
Balance at 1 July 2006	Trust	3,326,747		3,095,461
	Research Centre	361,705		360,549
Net Surplus for year		86,372		232,442
			3,774,824	3,688,452
Reserves				
Maintenance Reserve (note 5)		18,070		16,070
Revaluation Reserve		24,635		24,635
Balance at year end (note 6)			42,705	40,705
	Total equity (note 8)		3,817,529	3,729,157

For and on behalf of the Trust

_____ Trustee _____ Trustee

Date: 11 September 2007

NOTE: This Statement is to be read in conjunction with the Notes to the Financial Statements

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Asset and Depreciation Schedule for the year ended 30 June 2007

	Cost Price	Book Value 1 July 2006	Additions	Depreciation charged this year	Accumulated depreciation as at 30 June 2007	Book Value 30 June 2007
LAND & BUILDINGS						
Grovetown Park						
State Highway One	531,723	457,668		6,231	80,286	451,437
Research Centre						
Budge Street	2,262,988	2,053,544		84,193	293,637	1,969,351
	2,794,711	2,511,212		90,424	373,923	2,420,788
PLANT & EQUIPMENT						
Research Centre						
Budge Street	273,355	185,588	43,473	39,667	127,434	189,394
Rowley Vineyard	11,916	6,265		1,340	6,991	4,925
	285,271	191,853	43,473	41,007	134,425	194,319
MOTOR VEHICLES						
Rowley vineyard	7,366	539		83	6,910	456
Research Centre						
Budge Street	9,752	5,598		1,329	5,483	4,269
	17,118	6,137		1,412	12,393	4,725
FURNITURE & FITTINGS						
Grovetown Park						
State Highway One	22,850	4,666	2,613	1,099	19,283	6,180
Research Centre						
Budge Street	30,752	20,365	2,572	4,384	14,771	18,553
	53,602	25,031	5,185	5,483	34,054	24,733
VINEYARD						
Development expenditure	116,350	71,788		8,281	52,843	63,507
Irrigation	12,073	6,845		986	6,214	5,859
Netting	9,128	4,185		1,105	6,048	3,080
	137,551	82,818		10,372	65,105	72,446
TOTAL ASSETS	3,288,253	2,817,051	48,659	148,699	619,900	2,717,011

NOTE: This Statement is to be read in conjunction with the Notes to the Financial Statements

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Notes to Accounts

1. **STATEMENT OF ACCOUNTING POLICIES**

The financial statements here presented are for the entity **Marlborough Research Centre of Excellence Trust**, a charitable trust registered under the Charitable Trusts Act 1957. Marlborough Research Centre of Excellence Trust is a reporting entity under the Financial Reporting Act 1993. These Financial Statements have been prepared in accordance with generally accepted accounting practice.

The accounting principles recognised as appropriate for the measurement and reporting of earnings and financial position on an historical cost basis have been used, with the exception of certain items for which specific accounting policies have been identified.

(a) **Changes in Accounting Policies**

There have been no changes in accounting policies. All policies have been applied on bases consistent with those used in previous years.

(b) **Income Tax**

The trust is not subject to income tax as per the Income Tax Act 2004, Section CW34. This approval was confirmed by the Inland Revenue Department on 12 October 2004.

(c) **Receivables**

Receivables are stated at their estimated realisable value. Bad debts are written off in the year in which they are identified.

(d) **Fixed Assets**

Fixed Assets have been included at cost less accumulated depreciation. Details of fixed assets are set out in the attached Fixed Asset Register.

(e) **Depreciation**

Depreciation has been charged on a cost price or diminishing value basis, in accordance with the method and rates currently approved by the Inland Revenue Department. Details of rates and depreciation claims are set out in the Fixed Asset Register included herein.

(f) **Goods & Services Tax**

The Statement of Financial Performance has been prepared so that all components are stated exclusive of GST. All items in the Statement of Financial Position are stated net of GST, with the exception of account receivables and payables.

(g) **Differential reporting**

Marlborough Research Centre of Excellence Trust is a qualifying entity in that it qualifies for differential reporting as it is not publicly accountable, and is not large.

All available differential reporting exemptions have been applied.

2. **AUDIT**

These financial statements have been audited. Please refer to the auditor's report.

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Notes to Accounts

3. **INVESTMENTS**

Interest has been accrued to balance date. Investments are as follows:

Account #	Interest Rate	Maturity Date	Balance 30.6.07	Balance 30.6.06
3088	7.70%	05 Oct 07	158,881	
3090	7.40%	05 Jul 07	154,438	
3091	7.30%	4 Dec 07	52,431	
3093	7.15%	19 Oct 07	157,160	
3094	8.00%	01 Mar 08	52,138	
3095	7.30%	30 Nov 07	51,824	
3096	8.00%	07 Mar 08	62,189	
3097	7.40%	02 Jul 07	150,000	
3098	7.40%	08 Jul 07	50,000	
3099	7.40%	28 Jul 07	40,000	
3100	7.40%	28 Jul 07	50,000	
3101	7.60%	10 Sep 07	70,000	
3102	7.70%	23 Aug 07	100,000	
3103	7.70%	04 Oct 07	30,000	
3104	8.00%	01 Mar 08	100,000	
3105	8.25%	22 Mar 08	60,000	
3106	8.25%	22 Mar 08	50,000	
			$1,389,064	$844,787

4. **FIXED ASSETS (Refer to Schedule)**

Land and improvements were revalued by Valuation NZ as at 1 September 2002.

The Trust has not depreciated the buildings portion of the property revaluation. It is the view of the Trustees that such depreciation is not material.

Depreciation rates used are:

Grovetown Park buildings and amenities – 2% to 3% cost price, or 4% to 21.6% diminishing value.

Budge Street buildings and amenities – 4% to 18% diminishing value.

Plant and equipment – 12% to 48% diminishing value.

Motor vehicles – 12% to 26% diminishing value.

Furniture and Fittings – 12% to 39.6% diminishing value.

Vineyard – 6% to 39.6% diminishing value.

Additions this year include:

- Westinghouse Fridge & Freezer	2,844
- Centrifuge	2,285
- Weighing Balance	2,364
- SS winemaking kegs	7,102
- Electrical fit out of coolstore	2,126
- 2 x second hand coolstores	17,500
- Other plant and fittings	14,436
	$48,657

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Notes to Accounts

5. **POLICIES**

It is Trust policy that funds be set aside annually for the Maintenance Reserve. A further $2,000.00 has been added to the reserve in this financial year.

6. **RESERVES**

Movements in Reserves are as follows:	**2007**	**2006**
Opening Balance	40,705	38,705
Transfer to Maintenance Reserve	2,000	2,000
Closing Balance:	$42,705	$40,705

7. **TIMING OF CONTRIBUTIONS**

Although industry contributors have agreed to contribute annually for five years, not all contributors commenced payments at the same time and some contributors chose to wait until the new building was completed, the Research Leader appointed and new projects underway. In addition, contributors contribute for a calendar year (1 January to 31 December) whereas they are allocated to the financial year – July to June. The result is that at the end of each year we carry forward the proportion of those contributions which have been paid on an annual basis, which apply to the first six months of the ensuing year. This year the sum carried forward is $114,000. Some contributors will continue to make contributions to the centre beyond the final commitment date of the initial five year period which commenced 1 January 2003. The final contributions are scheduled for 2009.

8. **EQUITY**

Wine Research Centre

Wine Industry and Research Grant Funding			
2003	193,000		
2004	186,225		
2005	847,125		
2006	928,357		
Gross income to 30 June 2006		2,154,707	
Less Direct Costs			
2003	3,403		
2004	86,401		
2005	775,997		
2006	927,202		
	1,793,003		
Balance at 1 July 2006		$361,705	
Net surplus (deficit) on 2007 research projects			
Sauvignon blanc projects	4,066		
Wine industry projects	51,861		
New Zealand Winegrower's projects	(64,734)		
		(8,807)	
Wine Research Centre balance at 30 June 2007			$352,898

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Notes to Accounts

Marlborough Research Centre of Excellence Trust			
Balance at 1 July, 2006		3,326,747	
Net Surplus for the year		95,179	
		3,421,926	
Reserves			
Revaluation Reserve	24,635		
Maintenance Reserve	18,070		
		42,705	
Trust balance at 30 June 2007		$3,464,631	
TOTAL EQUITY BALANCE AT 30 JUNE 2007			$3,817,529

9. **REPAIRS & MAINTENANCE**

The items comprising property repairs in this financial year were all small repairs. There were no significant repairs (>$1,000) carried out during the year.

10. **OPERATING COSTS**

Operating and administration are made up as follows:

Trust Office, Administration and Operating Costs			
Annual Report	20,214	Property repairs	9,775
Accountancy	8,000	Promotional costs	9,243
Conference expenses (net)	718	Other costs	13,169
Office Expenses	6,873		
Computer Expenses	3,653		
			71,644

11. **ACCOUNTS PAYABLE**

	2007	**2006**
Trade creditors	227,909	23,427
Provision for audit fees	3,000	6,000
Holiday pay accrual	15,713	605
PAYE for June 2007	4,843	4,914
	$251,465	$34,946

12. **CONTINGENT LIABILITIES**

As at balance date there are no known contingent liabilities.

Marlborough Research Centre of Excellence Trust

Annual Report for the year ended 30 June 2007

Notes to Accounts

13. **COMMITMENTS**

Trustees approved applications for research grants of $120,000 on 25 July 2007. These grants will be paid as agreed with researchers during the 2007/08 financial year.

As at balance date there are no known capital commitments.

14. **EVENTS SUBSEQUENT TO BALANCE DATE**

The Trust has come to an agreement with HortResearch to manage all research projects commencing 1 July 2007. Research staff previously employed by the Trust, scientific equipment and funding streams has also been transferred as part of the agreement. It is anticipated that by combining all scientific resources into one group research outputs will be more effectively delivered and cohesively managed.

The Trust will continue to invest in scientific research, provide facilities to support research activity and administer a range of jointly funded programmes. The merged group will be in a position to grow research capability to benefit the Marlborough region and the New Zealand wine industry.

Under the terms of the new agreement HortResearch will remain in Marlborough.

15. **REVENUES**

The wine industry has provided funding as follows:

2007 year	$294,689
2006 year	$308,624
2005 year	$172,125
2004 year	$186,225
2003 year	$193,000

Wine Industry Contributions represents payments received from the wine industry which are allocated to the operating year on an accruals basis. Further contributions of $114,000 had been received at balance date. These will be allocated to the next financial year's operations. These advance receipts are shown under current liabilities in the balance sheet.

Other revenues - $12,600 - this is teaching income received from our research leader and complementary student scholarships.

16. **RESEARCH PROJECT RECOVERY**

Recovered from research projects $175,116. This is the gross amount the MRC Trust recovers from operations at the wine research centre ($78,916 for Sauvignon Blanc projects, $60,139 from Wine industry research projects, and $36,061 from New Zealand Winegrower's projects). These operating costs cover all personnel and overhead costs such as, vehicle costs, subscriptions, travel, staff conference costs etc.

Auditors Report

ANGELA WOOD
CHARTERED ACCOUNTANT

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56 Scoot Street
Blenheim

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AUDIT REPORT
To the Readers of the Financial Report of
MARLBOROUGH RESEARCH CENTRE OF EXCELLENCE TRUST

I have audited the financial report on the accompanying pages. The financial report provides information about the past financial performance of the Trust and its financial position as at 30 June 2007. This information is stated in accordance with the accounting policies set out in the report.

Trustees' Responsibilities
The Trustees are responsible for the preparation of a financial report which fairly reflects the financial position of the Trust as at 30 June 2007, and the results of operations for the year ended on that date.

Auditor's Responsibilities
It is my responsibility to express to you an independent opinion on the financial report presented by the Trustees.

Basis of Opinion
An audit includes examining, on a test basis, evidence relevant to the amounts and disclosures in the financial report. It also includes assessing:

- the significant estimates and judgements made by the Trustees in the preparation of the financial report; and
- whether the accounting policies are appropriate to the Trust's circumstances, consistently applied and adequately disclosed.

I conducted my audit in accordance with New Zealand Auditing Standards. I planned and performed my audit so as to obtain all the information and explanations which I considered necessary in order to provide me with sufficient evidence to obtain reasonable assurance that the financial report is free from material misstatements, whether caused by fraud or error. In forming my opinion I also evaluated the overall adequacy of the presentation of information in the financial report.

Other than in my capacity as auditor I have no relationship with, or interests in, the Trust.

Unqualified Opinion
I have obtained all the information and explanations I have required.

In my opinion:

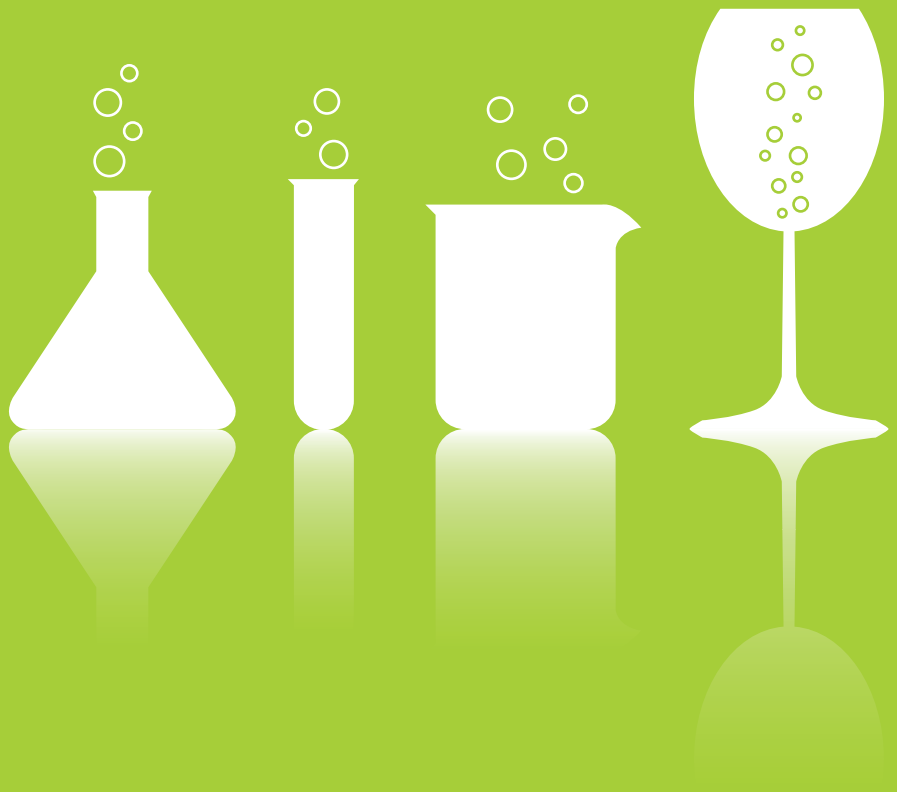
- proper accounting records have been kept by the Trust as far as appears from my examination of those records; and
- the financial report on the accompanying pages:
  - complies with generally accepted accounting practice in New Zealand; and
  - fairly reflects the financial position of Marlborough Research Centre of Excellence Trust as at 30 June 2007 and the results of its operations for the year ended on that date.

My audit was completed on 10 September 2007 and my unqualified opinion is expressed as at that date.

Angela Wood

Angela Wood
Chartered Accountant
Blenheim

CHARTERED ACCOUNTANTS



MARLBOROUGH RESEARCH CENTRE of EXCELLENCE TRUST
MARLBOROUGH WINE RESEARCH CENTRE

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