DAV 93/3

RETHINKING TECHNOLOGY TRANSFER

RIVERLINK

A report of a workshop
held at Mildura
on 9–10 December, 1993.

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1. EXECUTIVE SUMMARY

This is a report of a workshop, "Rethinking Technology Transfer" held on 9-10 December 1993. The workshop was initiated by Riverlink program leaders, and attended by 60 invited representatives. Participants were divided into four industry groups to define and discuss technology transfer relevant to the dried fruits, wine grape, table grape and citrus industries in Sunraysia-Riverland. Outcomes of the workshop were in the form of action plans dealing with key issues. Funds for the workshop were provided by Murray Darling Basin Commission, the Grape and Wine Research and Development Corporation, the Dried Fruits Research and Development Council, the Horticultural Research and Development Corporation, the Sunraysia District Citrus Cooperative Society, and the Citrus Board of South Australia.

1.1 COMMON ISSUES

Each group identified issues that were relevant to their own and to other industry groups, or the agricultural community in Sunraysia-Riverland. While each industry included the common issues within their own planning framework, it was recognised that cooperation was essential in dealing with these across-industry issues.

The major across-industry issues were:

- Financial management: Practical tools for growers (e.g. spreadsheet for financial analyses of property redevelopment), and skills training for growers in financial management.
- Information management: Improved access to technical information (e.g. information resource centres) and increased use or development of industry networks and groups to transfer information.
- Urban encroachment: Restrictions on farming practices or land use, together with development/redevelopment issues.
- Irrigation management: Cost and quality of water, improved irrigation efficiency, and nutrient and salt loads in drainage water.
- Agrichemicals: Withdrawal of chemicals from use, or restrictions in particular markets. A common approach between States and industries to residues and associated recommendations.
- Human resources: Improved and relevant (locally based, short course, on farm) training opportunities for growers.

- Property management planning: Development and redevelopment issues of whole farm planning, including supply and demand predictions.

1.2 INDUSTRY ISSUES AND ACTION PLANS

The dried fruit group were guided by the market requirements for high quality, combined with grower needs for high yields and minimal production costs. It was concluded that component technologies should be presented as part of an overall production package.

The wine grape group were concerned to meet the needs of an expanding industry. Information on supply and demand, together with adoption of "state of art" viticultural practices was important. Partnerships between service providers and the wine industry provided opportunities for more efficient technology transfer.

Priorities for the citrus group reflected the industry goal to reduce dependence on the concentrate juice sector. A range of management options to improve fresh fruit quality needed to be extended, primarily through Cittgroups.

The table grape group addressed the need for industry to control its own destiny, through introduction and use of industry funds for research, development and promotion. Greater industry cooperation and coordination would be facilitated by employment of an industry coordinator.

The action plans of the industry groups are in different stages of implementation. Substantial progress has occurred or will occur as a result of the workshop, notably:

- increased emphasis on group extension through Cittgroups, "Towards excellence in dried vine fruit" groups, and wine grape groups
- field days, workshops, and seminars run in collaboration by Riverlink agencies and industry organisations
- improved information resource centres developed by the Riverlink agencies
- greater use of new technologies (e.g. automatic weather stations, computer models) to improve flow of information
- increased collaborative targeted extension activities utilising resources drawn from different Riverlink agencies.

The action plans are dynamic, and will be reviewed in 1995, with the aim of further implementation of priority projects in 1995/96.

2. INTRODUCTION

Technology transfer is recognised as a limiting factor in the capacity to adapt to changing markets. The amount of technical information has increased dramatically, electronic media and devices have increased the capacity to communicate, and there are a greater variety of information sources available. However, the rate of change in horticulture is often perceived as inadequate, and declining public sector resources are forcing changes in extension provision and processes.

The Riverlink program leaders believe that there are opportunities to further develop and strengthen technology transfer programs. Sunraysia-Riverland has significant advantages in the breadth and depth of scientific expertise available in the region, and in the level of interaction with the horticultural industries. A workshop to identify, and address the major issues in technology transfer was seen as the first step in developing coordinated programs to facilitate and manage technological change in our horticultural industries.

The workshop was held at Mildura on 9-10 December, 1993. Over 60 invited participants from different segments of the grape and citrus industries met to identify major issues and action plans to address those issues.

The workshop activities were guided and facilitated by Jim Richardson (wine grapes), Chris MacIntosh (citrus), Tim Cummins (dried vine fruit), and Ralph Cadman (table grapes). The workshop was planned by a group that included industry representatives and Riverlink program leaders, under the guidance of Brian Clarke and Ian Ballantyne. Financial support for the workshop was provided by the relevant research and development corporations (GWRDC, DFRDC, HRDC), the Murray Darling Basin Commission, and local citrus organisations.

The outcomes of the workshop were in the form of action plans, which are documented later in this report. The action plans are in various stages of implementation, based on the commitment and resources available. The technology transfer plans and operations are dynamic, and will be reviewed in 1995.

3. INDUSTRY ISSUES AND ACTION PLANS

3.1 DRIED FRUITS GROUP

3.1.1 Priority Issues

The Dried Fruits Industry group used a questionnaire to seek the views of growers on the priority issues for technology transfer. The results of the questionnaire and the summary discussions of the results by workshop participants is given in Appendix 1. The group acknowledged that the guiding principles for a successful dried fruits industry were *quantity (high yield) with quality (demanded by the market place) produced at minimum cost.* It was concluded that the priority issues for technology transfer in dried vine fruit production were Plant Material, Trellising, Pest and Disease Management, Irrigation and Soil Management. For dried fruit quality they were Maturity, Drying and Contaminants. In the environmental area they were Water Quality/ Use Efficiency, Urban Encroachment and Chemical Withdrawal. The priority management issues were Financial and Information Management. It was agreed that future technology transfer programs should concentrate on presenting 'component' priorities such as improved planting material, taller trellises, more efficient irrigation systems etc. as part of an overall production package or packages.

To extend the 'package' (or 'packages') it was proposed that a network of "Land Care" style groups, tentatively called "Towards Excellence in Dried Vine Fruit Production" groups should be established in the dried vine fruit production areas in Victoria, New South Wales and South Australia. The concept was seen to be readily extendable to the currant producing areas of Western Australia, if the industry in that state saw merit in it. The grower groups should be task focussed based on mutual support and sharing of ideas and should drive the development of an overall production package or packages and their own information action plans. The group should be provided with administrative support (a group coordinator) and have ready access to technical and communication expertise of the government agencies. An implementation group was established to develop a process for formation of the "Towards Excellence" groups and to investigate the resources that may be required.

Industry was seen to have responsibility for driving quality improvement, which is ongoing through development of a quality code of practice, new classing standards, penalties, premiums and improved classing procedures, including the integrated classing and quality monitoring system. The

"Towards Excellence" groups would have a role in promoting awareness of the quality issues.

The group endorsed and supported the range of existing extension activities such as Horticultural Hotline, Harvest Hints, and Crop Watch Newsletter etc. and emphasised the need to ensure there is no diminution of existing agency extension inputs.

Activities aimed at improving awareness of water quality issues were also endorsed. Urban encroachment was seen as an industry problem, relevant to all industries in Sunraysia-Riverland. Withdrawal of agricultural chemicals was also seen as a cross-industry issue. However, it was acknowledged that government agencies had a role to play in advising industry of any information, local or overseas, that may indicate the possibility of a particular chemical being withdrawn.

Financial management and information management were also seen as major cross - industry issues. The ADFA's development of a computer spreadsheet model to assist in the financial analysis of property redevelopment was highly commended and supported. A model for improved information management based on the "Towards Excellence" groups and a primary information resource centre was also proposed. The model included grower developed 'information and technology transfer action plans' and a mobile information centre to service group information needs.

The workshop participants concentrated primarily on technology transfer for the dried vine fruits industry. It was noted, however, that the general principles might be transferable to the dried tree fruit industries.

3.1.2 Action Plans

Detailed action plans follow for the priority areas :-

(i) Facilitation to improve technology transfer to the dried fruits industry

(ii) Production Issues
- Plant Material
- Trellising
- Pest and Disease Management
- Irrigation
- Soil Management

(iii) Quality Issues
- Maturity
- Drying
- Contaminants

(iv) Environmental Issues
- Water Quality and Water Use Efficiency
- Urban Encroachment
- Chemical Withdrawal

(v) Management Issues
- Financial
- Information

Facilitation

Issues	Program Objectives	Strategies	Actions - What, How?	Who?	By When?
Facilitation to improve technology transfer to the dried fruits industry	• Establish a process for growers to determine information needs. • Facilitate delivery of information 'packages'.	•Form a network of task-focussed growers groups - "Towards Excellence in DVF Production Groups". • Seek funding to enable appointment of a facilitator •Access technical and government agency expertise	•Implementation group.	Peter McIntosh (ADFA) Ross Skinner (DFRDC) Rob Walker (Riverlink)	• Implementation group to meet before January 1994. • Funding to be sought, early 1994. • Appoint a facilitator 1995.

Production Issues

Issues	Program Objective	Strategies	Actions - What, How?	Who?	By When?
Plant Material	• Document best bet practices and quantify benefits of new varieties, especially rootstocks to facilitate adoption	• Include best bet management information in a package on improved production practices.	• Grower groups • Extension •Funding • Promotion of farm management planning services.	• Facilitator • Riverlink •DFRDC • Facilitator/ Sunraysia Salinity Management Implementation Group	• 1995-96 • Ongoing • 1995 • 1995 ongoing
	• Encourage farm management planning, to include short and long term plans.	• Encourage farm management planning before redevelopment; taking into account : - Soil texture - depth to watertable - soil salinity, etc.		• Facilitator/ DAV/other agencies	• 1995 ongoing
Trellising	• Increase adoption rates of taller trellises suited to mechanical pruning and harvesting	• Include information on the range of options in a package on improved production practices	• Grower groups • Extension	• Facilitator • Riverlink	• 1995-96 • Ongoing
		• Document successful case studies		• Facilitator	• 1995-96

Pest and Disease Management	• Higher yields of quality fruit	• Active extension of IPM type approaches for both pest and disease control	• Maintain successful extension activities - Horticulture Hotline - CropWatch Newsletter	• DAV and other agencies	• Ongoing
		• Computer based 'expert' systems	• Monitor progress e.g. AUSVIT	• CRCV (Greg Buchanan)	• Ongoing
Irrigation	• More efficient irrigation management	• Include best bet information in improved production practices package	• Extension • Grower groups • Irrigation management courses	• Riverlink • Facilitator • TAFE and Sunraysia Salinity Implementation Group	• Ongoing • 1995-96 • 1994 ongoing
		• Best bet demonstration blocks	• Establish 'best bet' systems as demonstration sites in grower group areas	• Facilitator	• 1995-96
		•Incentives/ Rebates	• Achieve adoption targets in Sunraysia Salinity Management Plan	• Sunraysia Salinity Implementation Group/Facilitator	• Ongoing

Soil Management	• Highlight importance of soil management in managing irrigation	• Field days	• Extension	• Riverlink	• 1995-96
		• Irrigated Crop Management Services	• Irrigation management course	• TAFE and Sunraysia Salinity Implementation Group	• Ongoing
	• Investigate and extend improved vineyard floor management practices.	• Research - Revised nutrient standards - Minimise tillage practices	•Trials on grower properties	• CSIRO-DAV	• 1992-95
				• NSW Ag.-CSIRO	• 1994-98
			• Extension	• Riverlink	• Ongoing

Quality Issues

Issue	Program Objective	Strategies	Actions - What, How?	Who?	When?
Maturity	•Maximise sugar yields and drying ratios	• Extend existing information on maturity	• Code of practice	• ADFA/Riverlink	• Harvest 1995 & on
			• Harvest hints	• DAV/Facilitator	• Harvest 1994 and ongoing
		• New research-objective measures of maturity	•Funding	• DAV - DFRDC	• 1994-97
Drying	•Improve quality by increasing adoption of emulsion application and finish drying recommendations	• Extend existing information	• Code of practice	• ADFA/Riverlink	• Harvest 1995 & on
			• Harvest hints	• DAV/Facilitator	• Harvest 1994 and ongoing
		• Packing shed protocols	• Bulk bin bar coding and trace back system	• Dried Fruits Boards/Packing Sheds	• Harvest 1995 & on
		• New research-objective measures of residual emulsion	• Funding	• CSIRO - DFRDC	• 1994-95

Contaminants	•Maximise quality by minimising contaminants and residues	• Continue research and extension to minimise contaminants and residues.	• Funding	• USA-DAV-CSIRO - DFRDC	• 1994-95
			• Code of practice	• ADFA/Riverlink	• Harvest 1995 & on
			• Harvest hints	• Dried Fruits Boards/DAV	• Harvest 1994 & on
		• Packing shed protocols	• Bulk bin bar coding and trace back system	• Dried Fruits Boards/Packing Sheds	• Harvest 1995 & on
			• ISO 9002	• Dried Fruits Boards/Packing Sheds	• 1993-96
			• DFRDC (funding)	• CSIRO-DFRDC	• 1994-97
		• Simple, low cost residue tests			

Environmental Issues

Issue	Program Objective	Strategies	Actions - What? How?	Who?	When?
Water quality and water use efficiency	• Improve water quality	•Salinity management planning	• Achieve targets in Sunraysia Salinity Management Plan	• Sunraysia Salinity Implementation Group	• Ongoing
	• Increase water use efficiency	• Extend existing information in a production package to include rootstock benefits	• Code of practise	• ADFA/Riverlink	• Harvest 1995 & on
			• Extension	• Riverlink	• Ongoing
			• Best bet demonstration blocks	• Facilitator	• 1995-96
	• Minimise drainage water for disposal	• Adopt efficient irrigation practice (re-use of water)	• Extension	• Riverlink	• Ongoing
			• Demonstration blocks	• RWC; CSIRO	• 1994-97

Urban Encroachment	• Develop a pro-active approach to urban encroachment issues	• Promote industry public good and safe farming practices		• ADFA	• Ongoing
		• Extend existing information on minimising noise, dust and spray drift	• Extension	• Facilitator	• 1995-96
		• Input to municipal and water authority planning	• Sunraysia Regional Development Strategy	• ADFA/SDC	• Ongoing
Chemical Withdrawal	• Anticipate and plan contingencies for possible withdrawal of key chemicals	• Actively seek information on status of key chemicals	• Chemicals data base	• Govt. agencies/ ADFA/Facilitator	• Ongoing
			• Relate use status to registration	• Facilitator	• 1995-96
		• Research to find alternatives	• Funding	• Riverlink agencies-DFRDC	• 1991-97

Management Issues

Issues	Program Objectives	Strategies	Actions - What, How?	Who?	When?
Financial	• Financial management spreadsheet for vineyard redevelopment	• Complete development and make available to growers and other stakeholders	• Define scope of the package and how stakeholders should 'see' the package	• ADFA	• Complete development by January 15, 1994
		• Promote in conjunction with whole farm planning	• Plan timing and form of release	• ADFA • Sunraysia Salinity Implementation Group	• Launch by mid 1994 • Ongoing
		• Extend information on rebates and incentives	• Extension/ Irrigation Management Courses/ Farm$mart/ Farmcheck etc.	• Riverlink and Sunraysia Salinity Implementation Group	• Ongoing

Information	• Develop and implement a model for improved information management	• Base on 'Towards Excellence Grower Groups'. Groups to determine information needs and action plans e.g. best bet trials, bulk buying, etc.	• Set up the 'Towards Excellence' groups	• ADFA/ Implementation group	• 1995-96
		• Investigate concept of an information resource centre and mobile centres.		• Facilitator	• 1994-95
		• Information data bases, e.g. rootstock performance		• Riverlink Agencies/Ian Ballantyne	• 1994-95
				• Riverlink Agencies/CRCV	• 1994-96

3.2 WINE GRAPES

3.2.1 Priority Issues

The wine grape industry in Sunraysia-Riverland is expanding rapidly, due to the strong demand for Australian wines in export markets. Both production and processing sectors are expanding, to the extent that Sunraysia-Riverland has become the commercial centre of the wine industry. The demand for moderately priced varietal wine grapes exceeds supply, which consequently flows on to multi-purpose varieties such as Sultana and Muscat Gordo Blanco.

The immediate needs of the wine grape industry in technology transfer concern market intelligence, rational planning of vineyard development or redevelopment; and information that enables grapegrowers to maximise production from existing vineyards. In the longer term, production efficiency and quality are the factors that will continue to determine the competitiveness of Sunraysia-Riverland grapegrowers.

Demand for, and supply of, wine grapes
The Australian wine industry set a target of $1 billion of exports by year 2000. To reach the target, production of varietal wine grapes needs to increase by 30-40%.

Investors and vineyard developers require information on the projected demand for wine grape varieties, quality parameters, and the likely prices for grapes. Given the 3 year lag before new vineyards come into production, projections of demand need to be frequently revised and communicated to vineyard developers.

Accurate statistics on wine grape plantings, including varietal characteristics and production targets, are essential to keep production levels in pace with demand.

Current shortfalls in the supply of varietal wine grapes are now partially met by diversion of multipurpose grapes from drying. As increasing quantities of varietal wine grapes become available, multipurpose varieties will be displaced, with potentially adverse effects on the dried vine fruit industry. The shifts in market preferences need to be monitored, and the adverse effects minimised.

Planning new vineyards
Development of new wine grape vineyards requires commitment of additional resources (finance, land and equipment, viticultural expertise). Planning for expansion of the wine grape industry needs to include:

- economic information to attract investment capital
- additional or enhanced skills in business planning
- "state of art" technical information on vineyard development
- training requirements for viticultural staff
- technical capacity to optimise the production of grapes for desired wine styles.

Production for existing vineyards
Wine grape growers can increase their current production and profitability from existing vineyards through increased adoption of new technology (e.g. irrigation, pest and disease management; improved trellis and canopy architecture; increased mechanisation).

Significant improvements in production should be possible in the short term through adoption of available technology.

Service delivery
New communication technologies (e.g. facsimile services, recorded telephone messages, computer "expert" systems) offer good potential for timely and efficient transfer of information. These technologies have already been applied successfully to raise awareness of pest and disease infestations. Their use needs to be extended further to link with networks of automatic weather stations, and to incorporate other applications (e.g. irrigation, nutrition).

Equally important are the opportunities to form partnerships amongst service providers. Riverlink provides the mechanism for coordinated delivery of research and extension services, as well as better access to a greater array of technical expertise than was available in the past. Similarly, partnership with wine companies, grower associations, and agribusiness groups facilitates extensive and efficient interchange of information.

3.3.2 Action Plans

Action plans follow to address the following issues:

(i) Supply and demand
- grape utilisation survey
- grower production census
- export price signals

(ii) Property management planning
- financial planning
- personnel skills
- production plans

(iii) Pest and disease control
- spray application
- automatic weather stations
- common publications
- application rates

(iv) Rootstocks and scions
- rootstock management
- varietal selection

Supply/Demand

Issues	Program Objectives	Strategies	Actions - What, How?	Who?	By When?
Grape utilisation survey - dissemination	Better grower knowledge of winery demand.	• Joint planning for the Riverland and Sunraysia: • Media publicity • Annual seminar • Distribute through grapegowers meetings	No. growers at seminar No. copies sold	MVGIAC	Aug 94
Grower Production Census	Forecast grape supply for next 5 years	• Estimate intended planting from Nursery sales • Estimates of production from existing plantings	• Surveys annual • Spreadsheet Model • Proportion of respondents • Access Phylloxera Board data	MVWGGC	
Inaccurate ABARE projection	NO ACTION				
Quality • Maturity • Sound management of grafted vines	NO ACTION				
Export price signals	Specify export returns to growers. Define market price points.	Better dissemination of available national information	Seminar annually	MVWGGC	

Property Management Planning

Issues	Program Objectives	Strategies	Actions - What, How measured?	Who?	By When?
Financial planning	• Sound business • Planning reasonable return on investment • Sustainable investment	Standard business plan and development budget models based on realistic local figures. Plus person to assist/interpret.	- Identify existing models evaluate and combine for standard Sunraysia-Riverland/MIA format. - Get figures (accurate) credible. - Economist to train and provide quality control for info providers (Banks, Agencies, consultants).	•NSW, SA & Vic Agriculture Dept. •Financial Institutions	1995 on
Personnel Skills	Ensure trained/skilled work-force - Owners operators and hired labour.	• training courses (TAFE). Targeted courses • Industry sponsorship	- Financial incentive for participation (cross compliance) - demonstrate financial benefit Range of courses/levels developed and delivered in co-ordinated way: Co-ordinated across state borders - competency based: - Train the trainers - Technical packages - Farmer info centres Review pilot course	TAFE, Industry, Agencies, Regional Training Boards, CSIRO	1995

Production Plans	Improve profitability and sustainability	Adequate information and demonstration of benefits • soil surveys • irrig. system design • layout (row x vine x height) • drainage • planting varieties • canopy management • mechanisation/equipment • sheds/buildings	- Develop best bet practices for various situations and document - Provide training/service on consultancy basis in whole farm planning, systems approach (ICMS model or Farm $mart)	Depts. of Ag. Industry R&D providers	1995 on

Pest and Disease Control

Issues	Program Objectives	Strategies	Actions - What, How measured?	Who?	By When?
Spray application	Ensure spray equipment is utilised to best efficiency with regard to- Application Coverage Volume Timing. -	• Awareness campaign • Demonstration of current best practice	• Demonstrations of: calibration and spray plant set-up application; canopy management implications • Co-ordination meeting • Assess potential 'check' service	MC GF R Emmett project interface	1994-97
Network of automatic weather stations	Growers access to automatic weather data configured files Grower use of data (services)	(1) Circular for expression of interest in EMU's (Environment Monitoring Units) - who has them?; who wants them? (2) Meeting of interested parties to study feasibility. (3) Coordinate resources needed (4) Central data base (maintenance) (5) Interpretative services from data base. (6) Survey of fax./phone services.	(1) Physical network (2) Maintenance aspects and fee arrangements (3) Use of service	GAB APM GD, Wineries Max Tolsen Bill Wilden	1994 on

Common Pest and Disease Publications	Sunraysia-Riverland recommendations	S-R Program leaders to set up plan and review process	Joint S-R publications	GAB GD RW KB	Jul 94
Application rates of chemical for pest and disease control	Application rates of chemical be sought from Chemical companies	Canvas chemical companies to trial their chemicals in regions with large or small canopies/trellis with the object to indicate requirements for optimal spray cover.	Contact chemical companies. Review data from existing trials.	AM, RWE	

Rootstocks and Scion Varieties

Issues	Program Objectives	Strategies	Actions - What, How measured?	Who?	By When?
Wine style and rootstock management	Proper use of rootstocks for wine grapes	1. Coordination of information 2. Dissemination of information. 3. Seminar/workshop e.g. "ASVO" seminar, travelling road show.	Rootstock review by Peter May. Revisit district field trials. Field days using commercial plantings.	Nurseries, Vine Improvement Committees, Wineries, Growers Peter Murphy John Whiting Phil Nicholas	1995 (before cutting season)
Barriers to planting more preferred varieties e.g. Semillon.	To increase production of Semillon <u>Sunraysia</u> from 300 tonne to 7,000 tonne <u>Riverland</u> from 500 tonne to 4,200 tonne	Workshop to look at best possible production and establishment techniques for Semillon.	- Plan workshop - Publicise - Conduct	Murray Valley Grape Advisory Council and Riverland Grape Industry Committee	1994-95
Other varieties identified as being in short supply	Identify required production levels	Wineries to promote requirements	Awareness of opportunities through Newsletter/Seminars.	As above.	1995 on.

3.3 CITRUS

3.3.1 Priority Issues

The first task undertaken by the Citrus Group was to identify priority issues for industry development and technology transfer. Priorities were reviewed in relation to production, harvesting and handling, processing, marketing and financial management.

The key task facing the industry is to reduce dependence on the concentrate juice sector. Of particular concern is the need to expand export fresh fruit sales. Priorities identified by workshop participants reflect the need for industry to place greater emphasis on production for fresh fruit markets.

Production
Key production issues were seen as:

- Improving fresh fruit quality.
- Diversifying the varietal mix.

The requirement with fruit quality is to increase marketable yield per hectare by increasing the proportion of the crop in the large size counts and reducing blemish to increase percentage pack out. Diversification of plantings is required to reduce dependence on the Valencia orange which presently accounts for almost 50% of citrus plantings in the region. The Valencia orange is primarily seen as a processing orange and a reduction in the proportion of Valencias compared to varieties better suited to fresh fruit production is required to achieve a more balanced mix of varieties on properties.

The group felt that all aspects of crop management needed to be targeted in improving fruit quality. Specific issues raised were:

Nutrition
The main priority was seen as increasing the use of leaf analysis. Reasons suggested for the relatively low use of leaf analysis services were lack of confidence in the results, uncertainty about how to use the results to determine fertiliser requirements, and commercial bias in interpretation. Cost was not considered an issue. The group also felt that different standards were needed for the different citrus types and better guidelines were required for fertigation.

Irrigation
The link between irrigation and quality was generally thought to be poorly understood by growers and the main priority with irrigation was therefore seen as improving grower understanding of tree water requirements during critical growth stages. Irrigation scheduling programs were thought to be too complicated and needed to be simplified to promote adoption. The group also felt there was considerable scope to improve irrigation efficiency by promoting system checking and demonstrating how to make best use of existing irrigation systems on properties.

Pest and Disease Management
Spray application efficiency was seen as the current major problem. Demonstrating how to make best use of existing equipment through spray plant testing and providing training in equipment operation and maintenance were considered high priorities. Most growers could not afford to purchase new equipment. Although IPM programs have generally been well extended with good adoption, there were still widespread misconceptions among growers regarding IPM. In particular, the importance of monitoring needed further emphasis. It was thought that grower confidence in IPM had declined in recent years due to problems with scurfing.

Canopy Management and Crop Regulation
Increased adoption of pruning and thinning needed to be encouraged to improve fruit size. The group felt there was insufficient cost/benefit information on alternative pruning strategies and successful case studies needed to be documented. Variable results had reduced grower confidence in chemical thinning. Current recommendations needed to be reviewed and alternatives to present thinning agents investigated.

Orchard Redevelopment
Encouraging progressive replanting of old blocks with superior budlines was seen as an effective strategy to improve yields and fruit quality. The region is characterised by a relatively high proportion of old trees producing low yields and poor quality fruit of small size. Problems with small fruit size were generally more common in older plantings.

Although the need for orchard redevelopment and diversification of plantings has been accepted by industry, the lack of market intelligence on which to base decisions about what varieties to plant and the high costs associated with orchard redevelopment were major concerns. It was felt that insufficient information was available on the economics of alternative

redevelopment strategies. In particular, more information was needed on the relative merits of replanting versus reworking.

Harvesting and Handling
Issues raised in regard to harvesting and handling were:

- Improved efficiency of operations to reduce costs.
- Reduction of transit damage to improve outturn.
- Implementation of quality management systems.
- Improved feedback on pack outs.
- Innovation in packing and presentation methods.

The main priority for technology transfer was seen as the development and implementation of quality management systems at all levels within the industry. Oleocellosis damage induced by poor harvesting and handling practices was raised as a particular concern. Quality management was currently being actively promoted and it was important that these initiatives be maintained. More detailed feedback on pack outs would be beneficial to adjustment of on-farm management practices.

Processing
Maximising returns from fresh juice production was the prime concern. The industry has a natural competitive advantage with fresh juice and the market appears able to provide viable returns to growers.

Processing issues raised were:

- Cultural requirements for optimum fresh juice production.
- Contract supply system for price and delivery conditions.
- More efficient plant utilisation to minimise processing costs.
- Truth in labelling with respect to country of origin and contents.
- By-product development.

Marketing
Issues raised in relation to marketing were:

- Lack of coordination with orders, pricing and delivery to export markets.
- Excessive number of sellers.

- Lack of market knowledge.
- Poor communication to growers of market conditions and product outturn.
- Expansion of markets.

Improving coordination of marketing was seen as the responsibility of industry. The success of the Riversun navel export program to the USA was highlighted as an example of what could be achieved with proper coordination and planning. The further development of pest control strategies to meet export protocol requirements and the adoption of quality management within the industry were seen as the main priorities for expanding into new markets and maintaining market share.

Financial Management
In view of the changes occurring within the industry, improving the farm business management skills of growers was seen as a high priority. Improved skills were required in regard to record keeping, cashflow budgeting, assessing farm performance and developing business plans. Financial management was seen as a cross-industry issue.

Promoting Technology Adoption
Factors affecting technology adoption and developments needed to improve adoption rates were discussed by the group. Issues raised were:

- The lack of people to extend the information.
- The need for a greater focus on groups in extension programs.
- How to best service groups and provide group follow up.
- The need for more commercial resources in technology transfer.

The lack of people to extend technology was a particular concern and the group considered it vital that existing agency support for extension be maintained. The group identified an expanded role for Cittgroups in technology transfer. It was thought that Cittgroups might be able to assume a production role. As a matter of priority, the support needs of Cittgroups needed to be identified. The wider appointment of industry development officers funded by the industry also needed to be considered.

Initiatives suggested to promote the adoption of improved practices were:

- Establish best practice demonstration blocks on grower properties to increase grower confidence in new technology.
- Promote industry ownership of programs.
- Expand the involvement of local agents and consultants.
- Establish professionally maintained data bases to provide information to growers in a readily useable form.
- Seek appointment of a regionally based horticultural economist to carry out required financial analyses.

3.3.2 Action Plans

Action plans follow for the priority areas:

(i) Fresh Fruit Quality
- Nutrition
- Irrigation
- Pest and Disease Management
- Canopy Management
- Orchard Redevelopment
- Harvesting and Handling

(ii) Varieties
- Varietal Diversification

(iii) Processing
- Fresh Juice

(iv) Financial Management
- Financial Planning

(v) Facilitating Technology Transfer
- Cittgroups
- Information Management
- Regional Economist

Fresh Fruit Quality

Issue	Program Objective	Strategies	Actions - What, How measured	Who?	By When
Nutrition	Higher yields per hectare of fruit meeting market requirements	• Promote greater use of leaf analysis	• Conduct workshops on sampling procedures and interpretation of results	• NSWA and other agencies, National Cittgroup Coordinator	• 1994-95
			• Setup demonstration blocks on local properties to increase confidence in leaf analysis based recommendations	• SARDI and other agencies, Cittgroups	• 1995-96
			• Promote up-graded computer based interpretation system	• SARDI (P. Gallasch)	• Ongoing
			• Review standards for different citrus types	• SARDI - NSWA	• 1995-96
			• Monitor the number of growers using commercial services		
		• Develop guidelines for fertigation	• Review available information and assess need for further research	• NSWA - SARDI	• 1995-96

Irrigation	• Improve quality through better grower understanding of water requirements during critical periods	• Develop information package on best practice irrigation for quality	• Package available information in an easily understood format	• NSWA - DAV	• 1995-96
	• More efficient irrigation management	• Promote use of system design and checking services	• Publicise available services • Demonstrate how to best use existing system	• SARDI, PI (SA), DAV, NSWA	• Ongoing
		• Financial incentives	• Publicise rebate incentive schemes available in each state	• SARDI, DAV, NSWA	• Ongoing

Pest and Disease Management	Higher yields of marketable fruit through adoption of sustainable control programs	• Promote use of IPM control strategies and increase grower confidence in system	• Group activities in orchards • Conduct end of season reviews on demonstration blocks • Produce field identification kit • Highlight at Tri-State Field Day • Maintain "Horticulture Hotline" Program	• Riverlink Plant Protection Group	• Ongoing
		• Improve efficiency of spray application	• Demonstrate best use of existing equipment • Spray plant performance testing and operation training • Publish guidelines for machinery operation	• Riverlink Plant Protection Group	• Ongoing
		• Promote benefits of copper sprays	• Coordinate through packing sheds, Cittgroups	• PI (SA), DAV, NSWA	• Ongoing

Canopy Management	Increase adoption of current technology to improve fruit size and percentage packout	• Demonstrate benefits of pruning	• Establish demonstration blocks on grower properties • Document successful case studies • Provide economic evaluation of alternative pruning strategies - manual, hedging, topping, skirting • Hold pruning field day involving contractors	• NSWA, SARDI, National Cittgroup Coordinator	• 1994-98
		• Review chemical thinning recommendations	• Obtain grower feedback on responses to current practices	• SARDI (P. Gallasch)	• 1995-96
		• Investigate alternative canopy management strategies for mandarins	• HRDC submission	• NSWA - SARDI (K. Bevington)	• 1995-98

Orchard redevelopment	Encourage progressive replanting of old orchards to improve yield and fruit size by adopting superior budlines and reducing average age of plantings	• Promote benefits of improved budlines • Promote property management planning	• Extend latest information through Cittgroups and "Variety Talk" Newsletter • Compile available information on alternative orchard replanting strategies • Carry out cost/benefit analysis of options	• All state agencies, CSIRO • NSWA and other agencies • Regional Economist	• Ongoing • 1995-96
Harvesting and Handling	Implement Quality Management best practice from orchard to packing shed Minimise oleocellosis damage	• Promote on-farm QM through Cittgroups and workshops • Promote certification of packing sheds • Grower, picker and packer education	• Continue existing regionally coordinated program • Group work site demonstrations - how to avoid oleocellosis and other problems	• NSWA, PI (SA), DAV, HRDC • PI (SA), CSIRO, NSWA, packing sheds	• Ongoing • 1994 ongoing

Varieties

Issue	Program Objective	Strategies	Actions - What, How measured	Who?	By When
Varietal diversification	Achieve more diversified varietal mix to meet consumer demands and increase fresh market opportunities	• Seek improved market intelligence on what varieties to plant	• Monitor and report on overseas and domestic market trends • Monitor varietal planting trends	• Marketing Boards	• Ongoing
		• Extend available information on alternative orchard redevelopment strategies	• Develop best practice information packages • Carry out cost/benefit analysis of options	• NSWA and other agencies • Regional Economist	• 1995-96
		• Continue evaluation of new varieties	• Set up National Appraisal Scheme to assess suitability for different growing areas and obtain market feedback • Use "Variety Talk" Newsletter to collate research and grower experiences	• All state agencies, CSIRO, HRDC, ACIA	• Ongoing

Processing

Issues	Program Objective	Strategies	Actions - What, How measured	Who?	By When
Fresh Juice	Increase returns from fresh juice production	• Promote adoption of cultural practices to optimise yield of fresh juice	• Best practice information package • Carry out cost/benefit analysis	• NSWA and other agencies • Regional Economist	• 1995-96
		• Promote adoption of specific fresh juice varieties	• Obtain data for local conditions from commercial on-farm trials	• NSWA - SARDI	• 1995-96
		• Identify variety/ rootstock combinations best suited to specific marketing periods	• Seek HRDC funding		
		• Promote contract supply system	• Clarify contractual arrangements	• Industry	
		• Assess potential for varieties other than oranges eg. tangelos	• Promotion campaigns by industry	• Industry	

Financial Management

Issues	Program Objective	Strategies	Actions - What, How measured	Who?	By When
Financial Planning	Improve farm business management skills of citrus growers	• Encourage participation in financial management workshops on record keeping, cashflow budgeting, assessing farm performance, developing business plans, etc.	• Publicise availability of services eg. Farm Cheque, Farm $mart	• Riverlink agencies, Industry	• Ongoing

Facilitating Technology Transfer

Issues	Program Objective	Strategies	Actions - What, How measured	Who?	By When
Cittgroups	Improve information transfer through Cittgroup network	• Promote greater interaction with Cittgroups • Identify support needs of Cittgroups	• Liaise with Cittgroups	• Riverlink Citrus Group, National Cittgroup Coordinator	• 1994 ongoing
Information Management	Implement improved information management system	• Investigate concept of an information resource centre • Develop appropriate data bases to provide information to growers in easily understood form	• Coordinate through Riverlink program • Liaise with Cittgroups to determine information needs	• Riverlink agencies • Riverlink Citrus Group, National Cittgroup Coordinator	• 1995 • 1994-96
Regional Economist	Improve technology adoption through economic analyses of existing practices	• Seek appointment of regionally based horticultural economist	• Investigate joint funding options	• Riverlink Program Leaders	• 1995-96

3.4 TABLE GRAPES

3.4.1 PRIORITY ISSUES

The priority issue for table grapes was for the industry to control its own destiny, through industry-based research, development and promotion. The introduction of a levy to provide industry funds, together with establishment of national industry committees to guide the use of resources was essential.

The table grape industry needed to develop policies for its projects that took into account:

- national priority of proposed projects
- outcomes that were relevant and capable of rapid adoption
- industry ownership and accountability for projects
- problem solving rather than research or extension driven projects
- economic evaluation of projects
- technology transfer plans that included market research and grower attitudes
- emphasis on achieving change for the better in industry.

Four main development issues were identified i.e.

- Best practice in production - documentation of best cultural practices, particularly those concerned with pest, disease and irrigation management; quality; and supply of ripe grapes to the customer.

- Industry coordination and cooperation - including marketing, shipping, provision of market signals, deregulation and regulation issues, and management of research and development.

- Postharvest and transport - documentation of best practice, reliability and cost of transportation and shipping.

- Marketing - Coordination of marketing, provision of market signals, back to producer and regulation/deregulation issues.

Common themes to emerge were the limited transfer of information within the industry, the lack of Government extension services, and the inadequate

(*ad hoc,* limited) research and development services. The knowledge base was very difficult for growers to access.

3.4.2 Action Plans

The two action plans to be documented were concerned with (i) the common theme of industry cooperation and coordination and (ii) the technical issues of pest and disease management in table grapes.

Pest and Disease Management

Issues	Program Objective	Strategies	Actions - What, How measured	Who?	By When
Effective and efficient Pest & Disease Management	Ensure effective pest and disease control is achievable by all growers.	- Cropwatch/Hotline - Production of high quality text - Publish lists of current relevant publications - Publish list of where information/ assistance can be obtained on a one-to-one basis - Videos - Field days - Short courses - Technical Conference	1. Survey existing users of publications like Cropwatch 2. Publish current relevant publications in Table Grape News as regular feature.	Industry (P. Smith) to contact Cropwatch and organise survey re Table Grape News. 2. K Leamon to discuss with Table Grape News Editor.	

Industry Co-ordination and co-operation

Issues	Program Objective	Strategies	Actions - What, How measured	Who?	By When
Market knowledge of producers. Best practices for producing table grapes.	- Improve grower understanding of all markets Australia is active in - Develop better understanding of table grape "best practice"	- Investigate new markets - Improve market intelligence - Investigate best practice	- Industry to employ co-ordinator to: • Investigate funding sources • Organise best practice study/project • Bring specialists in from overseas • Co-ordinate the gathering and distribution of market intelligence	Australian Table Grape Growers Association.	

APPENDIX 1

DRIED FRUITS GROUP
GROWERS QUESTIONNAIRE

Workshop participants were asked to complete a questionnaire seeking their views on what they believe to be the most important issues in the production (yield), fruit quality, property management and environmental areas for which there is available improved technology and information. They were also asked to consider examples of improved technology readily adopted, and examples less readily adopted, and the technologies that they (as growers) would invest in given the availability of finance.

Each participant was also asked to have three neighbouring growers each complete the questionnaire.

There were 29 respondents.

The responses are summarised as follows :-

PRODUCTION ISSUES

ISSUE	NO. RESPONDENTS RANKING IT :	
	TOP PRIORITY	IN TOP 3
Plant Material	15	20
Trellising	1	15
Canopy Management	2	6
Pest & Disease Control	1	15
Mechanical Pruning	0	5
Mechanical Harvesting	4	9
Irrigation System	5	11
Nutrition	0	5

One respondent ranked soil management the highest priority. The group noted that soil management was not among the production issues listed. It was subsequently agreed that soil management was an important issue. The discussion noted that too often, information was presented as single issues, rather

than as a package. Based on responses to the questionnaire and the discussion that followed, the group identified the key components of a production package as:-

- plant material (variety, clone, rootstock)
- trellising (including canopy management)
- pest and disease control
- irrigation (including irrigation management and scheduling)
- soil management (including cover cropping, nutrition and weed control)

Mechanisation was also seen to be important. The group acknowledged that the guiding principles for a successful dried fruits industry were :-

- *quantity (high yield), with quality (demanded by the market place), produced at minimum cost.*

  The group agreed that the 'ideal' production package should include mechanisation.

QUALITY ISSUES

ISSUES	NO. RESPONDENTS RANKING IT :	
	TOP PRIORITY	IN TOP 3
Maturity	14	26
Contaminants	9	19
Drying Oils and Application	0	19
Finish Drying	1	8
Chemical Residues	5	15

Two respondents gave equal ranking to contaminants and residues. It was noted that contaminants and chemical residues could be combined as a single issue. Similarly, emulsion application and finish drying were seen collectively as a 'drying' issue. On the basis of the responses and the ensuing discussion, the participants agreed that the important quality issues for technology transfer were:-

- maturity
- drying (emulsion application)
  (finish drying)
- contaminants (weed seeds, stones, sticks, etc.)
  (chemical residues)

MANAGEMENT ISSUES

ISSUES	NO. RESPONDENTS RANKING IT :	
	TOP PRIORITY	IN TOP 3
Financial Planning	17	29
Information Management	3	18
Occupational Health & Safety	0	6
Labour Management	3	9
Irrigation Scheduling	5	22

One respondent gave highest priority to 'whole farm planning'. Another respondent ranked 'understanding nutrition requirements' and 'timing application of chemicals' in the top 3. The group noted that irrigation scheduling was a production issue, rather than a management issue. Based on the responses and the discussion that followed it was agreed that the important management issues were:-

- financial management
- information management

ENVIRONMENTAL ISSUES

ISSUES	NO. RESPONDENTS RANKING IT : TOP PRIORITY
Water Quality	20
Urban Encroachment	3
Chemical Withdrawal	5

One respondent suggested 'climate change' was a high priority issue. However, 20 of the 29 respondents ranked water quality as highest priority, while a smaller number considered urban encroachment and chemical withdrawal to be high

priority issues. The group agreed that water quality (and sustainable production) issues needed to be considered in relation to the production 'package' and that urban encroachment and chemical withdrawal also required emphasis as information and technology transfer considerations.

RATES OF TECHNOLOGY ADOPTION

Through the questionnaire and discussion at the workshop, participants identified instances of successful technology adoption e.g. mechanical aids for handling fruit, rack-shakers, forklifts, boxing machines, new spray chemicals, pneumatic secateurs, narrow T trellis, best clones, rack-spraying, Carina currant etc., and less successful technology adoption e.g. trellis drying, rootstocks, Merbein Seedless, micro-irrigation, improved trellis (from T trellis onwards). Non-uniform adoption of technology was common in many instances. For example, the leading group of growers are often the first to adopt new technology with other growers preferring to wait and observe.

It was noted that adoption was most rapid in times of crisis and necessity and that technologies with good adoption were :-

- simple concepts
- relatively inexpensive
- generally 'off the shelf' items
- labour saving devices (without major change to the overall system)

Conversely, it was noted that technologies with poor adoption were :-

- often complex concepts
- poorly packaged or presented, with unclear benefits
- expensive

Other influencing factors included :-

- conservatism, resistance to change
- the long lived nature of vines, which in contrast to annual crops, is not conducive to rapid change
- property size and owner situations (age, etc)
- property infrastructure (trellis, irrigation etc.), also not conclusive to rapid change
- information flows (the tendency for 'bad' news to travel fast and 'good' news to travel slowly

Existing technology transfer was seen as :-

- not fostering adoption of available technologies as a package
- lacking financial analysis
- not making use of district experience
- lacking a defined objective
- not accounting for attitudes and age
- not consciously promoting intermediate steps in the technology adoption chain
- lacking in extension resources
- lacking market intelligence
- not taking account of timeframes

ISSUES COMMON TO OTHER INDUSTRIES

The principal common issues were seen to be financial and information management, urban encroachment, aspects of pest and disease management (including withdrawal of agricultural chemicals) and irrigation (water use efficiency).

APPENDIX 2

WORKSHOP PARTICIPANTS

Wine grapes Jim Richardson Brian Ferry Maurice Dean Max Tolson Bill Wilden Ian Schober Barry Avery David Ludas Peter Clingeleffer Bill Panagiotopoulos Greg Buchanan John Whiting Charles Thompson Ian Ballantyne Gerry Davies Scott Glyde Grieg Greenwood	**Citrus** Chris MacIntosh Kevin Cock Leigh Watmuff Peter Guild Mike Keenan Jeff Milne Terry Petersen Doug Chislett John Goddard Mark Chown Megan Edwards Greg Moulds Craig Feutrill Peter Gallasch Graeme Sanderson Steve Sykes Ken Bevington Fiona Manifold Craig Feutrill
Dried Vine Fruit Tim Cummins Peter MacIntosh Peter Vandenberg Brendon Gledhill Gary Thomas Tony Martin Mike Pullen Mike Worthington Ross Skinner Owen Lloyd Reg Johns Rob Hayes Rob Walker David Swain Graeme Robertson Frank DiMasi Bob Taylor John Goddard	**Table Grapes** Ralph Cadman Brian Woodford Brian Weston Peter Smith David Agg Barry Friend Nick Muraca Alan Anderson Keith Leamon Phil Nicholas Steve Panuccio John Hiskins Duncan Tullett Brian Clarke Greg Milner