AP98062
National integrated fruit production guidelines for Pome Fruit

D G Williams
Department of Natural Resources and Environment
Agriculture Victoria

HAL

Know-how for Horticulture™
This report is published by the Horticultural Research and Development Corporation to pass on information concerning horticultural research and development undertaken for the apple and pear industry.

The research contained in this report was funded by the Horticultural Research and Development Corporation with the financial support of the apple and pear industry and the Australian Fresh Fruit Company Pty Ltd.

All expressions of opinion are not to be regarded as expressing the opinion of the Horticultural Research and Development Corporation or any authority of the Australian Government.

The Corporation and the Australian Government accept no responsibility for any of the opinions or the accuracy of the information contained in this report and readers should rely upon their own enquiries in making decisions concerning their own interests.

Cover price: $22.00 (GST Inclusive)
HRDC ISBN 0 7341 0070 1

Published and distributed by:
Horticultural Research & Development Corporation
Level 6
7 Merriwa Street
Gordon NSW 2072
Telephone: (02) 9418 2200
Fax: (02) 9418 1352
E-Mail: hrdc@hrdc.gov.au

© Copyright 2000
National Integrated Fruit Production Guidelines for Pome Fruit

Final Report

Project Leader:
D.G. Williams
Department of Natural Resources and Environment
Agriculture Victoria
Institute of Sustainable Irrigated Agriculture
Tatura
Victoria, 3616
Australia

Copyright © Department of Natural Resources and Environment, 2000

This project was supported by funds from HRDC, AAPGA, DNRE, and AFFCO.

Disclaimers

This publication may be of assistance to you, but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication. The advice provided in this publication is intended as a source of information only.

Any recommendations contained in this publication do not necessarily represent current HRDC policy. No person should act on the basis of the contents of this publication, whether as to matters of fact or opinion or other content, without first obtaining specific, independent professional advice in respect of the matters set out in this publication.
Contents

Industry Summary 1
Technical Summary 2
Introduction 3
Materials and methods 3
Results and discussion 3
Industry adoption 4
Acknowledgments 5
Appendices:
1. Participants and outputs from the Integrated Fruit Production Workshop 6
2. Checklist used to survey growers for current practices 13
3. Results of survey of grower current practice 18
5. Comparison of Australian Apple IFP guidelines against EUREP guidelines 33
Industry Summary

The Australian Apple Industry wants to operate in an economically and environmentally sustainable way. Our markets are starting to expect, and in some cases demand, that producers are able to demonstrate that this is the case. At present the main push is coming from the UK distributors of exported Australian fruit, but there is a world-wide trend starting to appear. Many of our competitors are adopting Integrated Fruit Production to address these concerns.

What is Integrated Fruit Production?

An abridged definition of Integrated Fruit Production or IFP is “Economical production of high quality fruit giving priority to ecologically safer methods, minimising the undesirable side effects and use of agrochemicals, to enhance the safeguards to the environment and human health.”

In other words........

IFP is the cost-effective combination of Integrated Pest and Disease Management (IPDM), best practice irrigation and nutrition management, Quality Assurance (QA), food safety, Occupational Health and Safety (OH&S), and Farm Chemical User Certificate. These are all systems that the Australian fruit industry has adopted and therefore most producers should have little difficulty complying with the requirements of IFP.

Does IFP mean extra paperwork for growers?

Not if they are already using a quality assurance system based on Hazard Analysis Critical Control Point (HACCP). Most grower/packers already have some sort of HACCP based food safety accreditation. The Australian IFP guidelines are compatible and complementary to the QA programs in use in Australia. These programs will be given the opportunity to incorporate the necessary IFP principles so that one audit will cover both QA and IFP. This will reduce the amount of paperwork and cost of complying with IFP.

How is IFP being developed in Australia?

The Australian Apple and Pear Growers Association (AAPGA) and the Horticultural Research and Development Corporation (HRDC) commissioned David Williams from the Department of Natural Resources and Environment in the State of Victoria to develop National Guidelines for IFP for Apples in Australia. Mr. Williams assembled a project team that involved a technical panel of apple growers, R&D providers, agrochemical industry representatives, consultants and marketers. The Australian Fresh Fruit Company (AFFCO) provided additional funding and an export focus. This team worked in syndicate groups and a facilitated workshop to develop a draft set of guidelines. These were circulated widely and a number of seminars were conducted around Australia to get feedback from the apple industry. The first draft of the Guidelines was modified after comments from European experts on IFP, British importers of Australian fruit, growers and Departments of Agriculture in all apple-growing States in Australia.

The final document outlines the general principles and strategies to be used in Integrated Fruit Production (IFP) and was developed with the following considerations:

• Geographically, Australia is a large country and apples are produced in regions that may be many thousands of kilometres apart and which have large differences in both climate and soil types. While this does not alter any of the principles it does limit the usefulness of making very prescriptive rules for using the resources available and required in different regions.

• Many apple producers in Australia have already adopted QA programs and it is desirable that the IFP and QA programs are compatible and complementary.

• The Guidelines represent the minimum requirements for IFP in Australia. Resource manuals and other technical information that allow the development of more prescriptive regional guidelines will be developed after the National Guidelines are accepted by the Australian apple industry.
Technical Summary

The Australian Apple Industry wishes to implement a continuously improving Integrated Fruit Production (IFP) program that follows the general principles of International programs as defined by –

The economical production of high quality fruit, giving priority to ecologically safer methods, minimising the undesirable side effects and use of agrochemicals, to enhance the safeguards to the environment and human health. (International Organisation for Biological and Integrated Control of Noxious Animals and Plants (IOBC) and International Society for Horticultural Science (ISHS) Working Party on Integrated Fruit Production, 1998).

The program is being implemented because the Apple Industry has a desire to operate in an economically and environmentally sustainable manner. To achieve this, it is recognized that there is a need for efficient use of resources; minimum pollution and degradation of the environment; and high standards of safety for both participants in the industry and consumers of the fruit produced.

The Australian Apple and Pear Growers Association (AAPGA) and the Horticultural Research and Development Corporation (HRDC) commissioned David Williams from the Department of Natural Resources and Environment in the State of Victoria to develop National Guidelines for IFP for Apples in Australia. Mr. Williams assembled a project team that involved a technical panel of apple growers, R&D providers, agrochemical industry representatives, consultants and marketers. The Australian Fresh Fruit Company (AFFCO) provided additional funding and an export focus.

Draft guidelines were developed from the outputs of syndicate groups at a workshop on 21-22 October 1998. The workshop documents were edited to provide a consistent format but the meaning of the original outputs was not intentionally changed. The document also indicates to international bodies such as IOBC/ISHS that Australia has widely different growing regions where optimum use of resources could be different and that setting too many prescriptive limits may not be an effective way to progress IFP.

Rather than invent a completely new set of standards, rules, and recording systems that may conflict with or duplicate those in established QA schemes, we designed the IFP Guidelines so that they can be incorporated into the QA schemes. This would enable the QA Audit to become the audit of compliance with IFP.

The draft guidelines were circulated widely and a number of seminars were conducted around Australia for feedback from the apple industry. The first draft of the Guidelines was modified after comments from European experts on IFP, and feedback from British importers of Australian fruit, growers and Departments of Agriculture in all apple-growing States in Australia.

The Guidelines represent the minimum requirements for IFP in Australia. Resource manuals and other technical information that allow the development of more prescriptive regional guidelines will be developed after the National Guidelines are accepted by the Australian apple industry.
**Introduction**

The Australian Apple Industry wishes to implement a continuously improving Integrated Fruit Production program that follows the general principles of International programs as defined by –

*The economical production of high quality fruit, giving priority to ecologically safer methods, minimising the undesirable side effects and use of agrochemicals, to enhance the safeguards to the environment and human health. (International Organisation for Biological and Integrated Control of Noxious Animals and Plants (IOBC) and International Society for Horticultural Science (ISHS) Working Party on Integrated Fruit Production, 1998).*

The program is being implemented because the Apple Industry has a desire to operate in an economically and environmentally sustainable manner. To achieve this, it is recognized that there is a need for efficient use of resources; minimum pollution and degradation of the environment; and high standards of safety for both participants in the industry and consumers of the fruit produced.

**Materials and Methods**

The Australian Apple and Pear Growers Association (AAPGA) and the Horticultural Research and Development Corporation (HRDC) commissioned David Williams from the Department of Natural Resources and Environment in the State of Victoria to develop National Guidelines for IFP for Apples in Australia. Mr. Williams assembled a project team that involved a technical panel of orchardists, R&D providers, agrochemical industry representatives, consultants and marketers. The Australian Fresh Fruit Company (AFFCO) provided additional funding and an export focus.

Draft guidelines were developed from the outputs of syndicate groups at a workshop on 21-22 October 1998. Participants in the workshop and the outputs from the syndicate groups are shown in Appendix 1. The workshop documents were edited to provide a consistent format but the meaning of the original outputs was not intentionally changed. The section on “Harvest, storage and packaging” was not covered by a syndicate group but was ratified by the workshop. Environmental management was incorporated into the Introduction section of the draft guidelines.

The draft guidelines were circulated widely and a number of seminars were conducted around Australia for feedback from the apple industry. A survey of growers was conducted using a checklist (Appendix 2) designed to indicate current grower practice. A letter was attached to the checklist to explain to growers what the survey was about and how to complete it. The survey checklist was distributed at the seminars, by mail out to district based associations, and also at the ‘Snack Fruit 99’ Conference in Canberra in 1999. 150 surveys were distributed and 51 responses were received.

The first draft of the Guidelines was modified after comments from European experts on IFP, and feedback from British importers of Australian fruit, growers and Departments of Agriculture in all apple growing States in Australia.

**Results and Discussion**

The percentage of respondents who answered “yes” to questions in the checklist are shown in Appendix 3. The results suggest that more than 80% of growers have adopted IPDM. This is consistent with other surveys conducted by AAPGA and HRDC. The survey also indicated that growers were practicing most of the components of IFP but often did not have sufficient records of the environmental aspects of their business to satisfy an audit. When prompted, most were able to find scattered documentation and agreed that it would not be too difficult to compile the information in a suitable format.

Fruit growers already have considerable paperwork imposed on them and one of the barriers to adoption of IFP identified by the project team was the increased cost of documentation. Most growers supplying export markets and domestic supermarkets have implemented HACCP based Quality Assurance systems. The IFP guidelines we developed are compatible and complementary to QA programs in use in Australia. They can be incorporated into the QA manual so that a single audit can cover both QA and IFP. This will reduce the amount of paperwork and cost of complying with IFP.

Comparison of the Australian Draft IFP Guidelines with the EUREP Guidelines indicated that our guidelines should satisfy the UK distributors (Appendix 5).

The final draft guidelines are given in Appendix 4. These guidelines are being trialed by AFFCO for the 2000 export season to the UK. The Guidelines represent the minimum requirements for IFP in Australia. Resource manuals and other technical information that allows the development of
performance parameters will be developed after the National Guidelines are accepted by the Australian apple industry. A proposal has been submitted to HRDC seeking funds to develop the resource manuals and a mechanism for adoption of IFP.

**Industry Adoption**

The development of these guidelines has been widely publicised at grower meetings, seminars, conferences, field days, technical days, and in industry journals and newsletters. AAPGA has contracted AFFCO to administer the Australian National Apple IFP Register on their behalf. Registration is open to all growers who are able to demonstrate compliance with the guidelines. A scoring system has been developed using a modification of the checklist used for our survey of current practices. Registration forms and the modified checklist are available from AFFCO.

**Acknowledgements**

Funding for the project was provided by HRDC, AAPGA, AFFCO, and DNRE via the ExpHort 2000 Initiative World Class Apple project. The cooperation and collaboration of the workshop participants, and the positive attitude expressed by all sectors of the industry is greatly appreciated.
Appendix 1

Participants and outputs from the Integrated Fruit Production Workshop conducted at Knoxfield, October 1998
INTEGRATED FRUIT PRODUCTION WORKSHOP

IHD KNOXFIELD 21 - 22 OCTOBER 1998

<table>
<thead>
<tr>
<th>Chair</th>
<th>D. Williams</th>
<th>DNRE Vic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ian Armour</td>
<td></td>
<td>Orchardist, Vic.</td>
</tr>
<tr>
<td>Tom Batchelor</td>
<td></td>
<td>DPIWE, Tas</td>
</tr>
<tr>
<td>Sally Bound</td>
<td></td>
<td>TIAR, Tas</td>
</tr>
<tr>
<td>Peter Burgi</td>
<td></td>
<td>Orchardist, Vic.</td>
</tr>
<tr>
<td>Peter Del Santa</td>
<td></td>
<td>Novartis</td>
</tr>
<tr>
<td>Andrew Dick</td>
<td></td>
<td>AFFCO</td>
</tr>
<tr>
<td>David Finger</td>
<td></td>
<td>Orchardist, Vic.</td>
</tr>
<tr>
<td>Robin Fitzgerald</td>
<td></td>
<td>I. K. Caldwell</td>
</tr>
<tr>
<td>Ron Gordon</td>
<td></td>
<td>Batlow Cooperative, NSW</td>
</tr>
<tr>
<td>Kym Green</td>
<td></td>
<td>Orchardist, S.A.</td>
</tr>
<tr>
<td>Paul James</td>
<td></td>
<td>PIRSA</td>
</tr>
<tr>
<td>Peter Jerie</td>
<td></td>
<td>DNRE, Vic.</td>
</tr>
<tr>
<td>Gordon Johns</td>
<td></td>
<td>Orchardist, Vic.</td>
</tr>
<tr>
<td>Bill Joyce</td>
<td></td>
<td>Orchardist, S.A., Vic</td>
</tr>
<tr>
<td>Roger Loveless</td>
<td></td>
<td>Bayer</td>
</tr>
<tr>
<td>Stuart Pickworth</td>
<td></td>
<td>Orchardist, Vic.</td>
</tr>
<tr>
<td>John Plummer</td>
<td></td>
<td>Orchardist, S.A.</td>
</tr>
<tr>
<td>Trevor Ranford</td>
<td></td>
<td>Apple and Pear Growers Association of S.A.</td>
</tr>
<tr>
<td>Paul Rapley</td>
<td></td>
<td>DPIWE, Tas.</td>
</tr>
<tr>
<td>Malcolm Roach</td>
<td></td>
<td>Independant Horticultural Distributors</td>
</tr>
<tr>
<td>Bruce Scott</td>
<td></td>
<td>E.E Muirs</td>
</tr>
<tr>
<td>Norm Stone</td>
<td></td>
<td>Agrevo</td>
</tr>
<tr>
<td>Peter Valentine</td>
<td></td>
<td>ServAg</td>
</tr>
<tr>
<td>Ralph Wilson</td>
<td></td>
<td>Orchardist, NSW.</td>
</tr>
<tr>
<td>Bill Thompson</td>
<td></td>
<td>Vic.</td>
</tr>
</tbody>
</table>

Syndicate Groups

**IPM (Including weed control and postharvest disinfestation)**
- P. Rapley (Group Leader), T. Batchelor, P. Dalsanto, A Dick, D. Finger, R. Loveless

**Irrigation/Nutrition**
- P Jeric (Group Leader), G. Johns, B Scott, P. Valentine

**Crop/Growth Regulation**
- S. Bound (Group Leader) P. Burgi, S Pickworth, T. Ranford

**Orchard Establishment**
- P. James (Group Leader) B Joyce, K. Green, R Wilson

**Spray Application**
- R Fitzgerald (Group Leader) R. Gordon, J. Plummer, N. Stone

**General Framework and Introduction**
- A Dick, (Group Leader) all workshop participants
Outputs from Syndicate Groups

Each Syndicate Group was given the task of compiling principles and strategies for their topic. They were also asked, if time permitted, to consider any actions necessary to implement the strategy. The following pages contain the outputs from each Syndicate Group as transposed from the hand written notes on butchers paper.

Integrated Pest Management

Principles

IPM uses and encourages continual improvement in pest control measures that have minimal impact on the environment and human health and which promote sustainability and profitability for all participants in the value chain and the community.

Strategy

Decisions taken for minimizing the risk of pest damage depend on integrating information on pest life cycles, the pest-beneficial balance, pest action threshold, likely effectiveness of the control measure, weather conditions, environmental impact, requirements of the community and consumer preference.

More specifically, this includes:

- Carrying out best practice for orchard sanitation and cultural control that removes sources of infection/infestation and avoids pest build-up;
- Implementing practices such as sward cover, buffer trees that conserve beneficials in the orchard;
- Identifying problem areas in the orchard as both an indicator of a possible problem in the whole orchard, and as a target for specific control;
- Giving preference to methods that are pest-specific and least hazardous to the environment and human health;
- Using regionally-based, pest specific action thresholds; recording the decision whether to use a pest control measure or not; noting the pest control measure and the target, and subsequently evaluating the results of the treatment
- Compliance with pest resistance management guidelines, as stated by government authorities and grower organizations and manufacturers;
- Selecting pesticides based on consideration of residues, withholding period, harvest date, compatibility with biological control methods, efficacy, minimal impact on the environment and safety for orchard staff;
- Observing all label requirements for chemicals where it may be necessary to use them, especially the withholding period; and
- Discouraging routine chemical applications except where there is a risk of latent infection or infestation as such preventative measures may be the only practical approach to minimize overall chemical usage.

Actions

In order to achieve these outcomes, the following need to be adopted:

- Effective and ongoing training;
- Carry out appropriate monitoring of pests and beneficial organisms;
- Recording all the elements that contribute to making a good pest management decision, following good spray application guidelines (see**)?;
- Treatment according to the above principles;
- AND OTHERS FOR OTHER LINKS TO OTHER CHAPTERS IN THE GUIDELINES
Environmental management

Principle

Environmental management considers and recognizes that sustainable fruit production in Australia requires the maintenance and enhancement of our unique environment.

Strategy

The conservation and efficient use of resources including energy, water and land; incorporating safeguards against pollution, waste and utilizing the principle of recycling.

Actions

- Resource management
  - Water
  - Energy
  - Land
  - Soil
  - Vegetation (Flora)
  - Fauna

- Safeguards
  - Spills – barriers; recycled
  - Containers – Avcare guidelines
  - Runoff – erosion
  - DPA

- Recycling
  - Orchard
  - Packaging
  - Community wastes
  - Lubricants
  - Composting/mulching
  - Green waste
  - Waste fruit/Bins
  - Government policy/involvement
  - Recyclable containers

Crop Management

Principles

Crop management is aimed at achieving a balance between tree growth and yield while optimizing fruit quality.

Strategy

1. Growth

Decisions taken to optimize growth will take into account tree structure to allow: (1) good light penetration for the maintenance of productivity and production of high quality fruit; (2) Optimal spray penetration, thus increasing efficiency and effectiveness of spray applications. Well-balanced trees allow for the efficiency of harvest labour and minimize damage to fruit. In order to achieve these outcomes the following need to be adopted:

- Encourage the use of appropriate rootstocks for variety and site as they become available.
• Use of appropriate training and pruning techniques to optimize the selected growing system;

• Use of cultural methods such as reducing fertilizer application, regulated deficit irrigation, cincturing, increased floor competition where appropriate to limit vigour;

• Use of plant bioregulators where appropriate to control excess vigour and achieve economic production

2. Yield

Decisions taken for the management of flowering and fruit set are based on the achievement of consistent bearing and optimal crop loads essential for economic production. In order to achieve these outcomes the following need to be adopted:

• Where appropriate use of registered plant bio-regulators to break dormancy and shorten the flowering period;

• Use of appropriate recommended thinning programs using registered plant bio-regulators to reduce excessive fruit set;

• Maintenance of appropriate records.

Spray Application

Principles

Pesticides, bio-regulators and nutrients should be applied efficiently taking into consideration; efficacy, energy conservation, avoidance of drift and safety of operators, consumers and the environment.

Strategy

Tree volume should be the basis for establishing dilute water volume for foliar applications. Dilute water volume should be used for determining the correct dose rate (Rate/ha). Weed control should be based on timely applications to maximize efficacy.

Actions

• All operators will be adequately trained or will have successfully completed an approved Farm Chemical Users Course;

• Select weather conditions to maximize product efficiency and minimize environmental impact (drift);

• Appropriate protective clothing and equipment must be used and closed filling systems should be considered;

• Calibrate equipment annually or according to manufacturers guidelines and continuously record, monitor and maintain;

• Orchard filling and washdown areas should be located to minimize the risk of environmental contamination;

• Pesticide containers should be disposed of according to Avcare guidelines.

Nutrient Management

Principle

Optimize the production of quality fruit by monitoring and applying nutrients efficiently, according to need, while minimizing any environmental impact.
Strategy
Decisions for nutrient application are based on the monitored crop requirements. Applications use techniques that minimize off-site movement and soil degradation. Nutrient management will be continuously reviewed and improved.

Actions
- Regular soil, fruit and plant tissue analysis
- Record nutrient applications

<table>
<thead>
<tr>
<th>Material</th>
<th>Method</th>
<th>Timing</th>
<th>Quantity</th>
</tr>
</thead>
</table>
- Develop nutrient management programs based on historical records, orchard performance and appropriate interpretation of soil, fruit and plant tissue data.
- Organic material may be used if analysis specifies nutrient content and suitability.

Considerations:
- Monitoring of off-target nutrient concentration e.g. groundwater, run-off:
- Development of appropriate training packages to enable growers to make more informed decisions and continuously improve nutrient management.

Irrigation Management

Principle
Water is a scarce resource in Australia. It must be used efficiently, effectively and monitored to optimize fruit production and quality with due consideration to the environment.

Strategy
Irrigation management decisions are based on water availability, quality and appropriate application methods to optimize productivity and water use efficiency.

Actions
- Monitor and record

<table>
<thead>
<tr>
<th>Water quality</th>
<th>Methods</th>
<th>Application rates</th>
<th>Timing</th>
<th>Rainfall events</th>
<th>Scheduling</th>
</tr>
</thead>
</table>
- Irrigate applied nutrients to ensure that nutrients remain in the rootzone of the trees:
- Where practical, irrigation run-off is recycled;
- Develop appropriate training packages to enable growers to better understand irrigation scheduling and management:
- Adopt irrigation practices that optimize water infiltration and enhance orchard floor management.

Orchard Establishment

The design and establishment of orchards should use appropriate planning, planting systems and management practices that result in profitable and sustainable plantings which minimize the potential degradation and environmental impact.

Strategy
To enhance orchard performance and minimize environmental impact, management decisions should carefully consider site selection and land management practices that:
- Increase biodiversity
- Maintain or enhance water quality
- Reduce soil and environmental degradation minimize chemical usage.
Planning
• Growers are encouraged to use Property Management Planning/Farming for the future principles:
  
  Refer to National strategy program?

• Replant planning is encouraged to ensure timely activities, ordering of appropriate planting material and minimizing site management problems.

• Planting system selection. The preferred choice of planting system will consider variety, rootstock, spacing, training support systems and row orientation will result in well balanced trees requiring the minimum of chemical intervention for optimum production. Climate, soil potential and site characteristics must also be considered in planning the planting system.

Orchard Biodiversity
• Revegetation/retention of natural vegetation to be encouraged for the enhancement of the natural environment and climate protection of the local area.

Waterways
• Our aim is to encourage the protection and maintenance of waterways and natural vegetation.

• The siting of man-made structures be subject to local planning guidelines/regulations and minimize the impact on local waterways.

• All management activities will endeavour to minimize the chemical degradation of waterways and water quality

Irrigation
• Irrigation systems must be based on crop, soil, site, environment and local requirements.

Site preparation
• Aim to create optimal conditions for trees

• Limitations such as compaction, drainage, waterlogging, salinity, pH, nutrient imbalances to be corrected where scientific assessment indicates they are required:

• Everything possible should be done to maintain the structure of the soil and minimize the potential of erosion and ground water contamination;

• Fumigation and other chemical applications to control soil borne pathogens, nematodes or specific replant disease may only be used where bioassays or scientific tests or analyses indicate a need.

Orchard floor management
• Wherever practical an orchard sward should be used to minimize soil compaction, dust contamination, assist in weed control and maintain biological diversity in the orchard to enhance beneficial predators.
Appendix 2
Checklist used to survey growers for current practices.
Dear Fruitgrower

As part of the process for developing national guidelines for Integrated Fruit Production for Australia I visited growers in most apple growing districts in Australia. During those visits I presented the draft guidelines and many growers volunteered to participate in a pilot study to assess the guidelines. By the time I finished visiting the various districts it had become obvious that growers would value a checklist that they could use as a prompt. The checklist could also allow me to assess the sort of information that growers already had and that could be used to show they complied with IFP guidelines.

The attached checklist covers all sections of the draft guidelines. It is not meant to indicate that you need all the things that are listed. It is simply to find out what you do or do not have on hand. There are no right or wrong answers.

Can you please work your way through the checklist. All you need to do is read each statement and then circle YES if the statement applies to your situation, or NO if it doesn’t. Once you finish going through the checklist please make a copy for your own records and then send a copy back to me.

Replies can be either faxed to 0398873609 or posted to:
D.Williams
Agriculture Victoria Knoxfield
Private Bag 15
South Eastern Mail Centre
VIC 3176

There is no need to put your name on the reply but feel free to do so if you want.

I need replies by 28 May 1999 so I can analyse them and include the results in a report to HRDC and AAPGA.

Thank you in anticipation of your assistance

David Williams
Project Leader, Australian National Guidelines for Integrated Fruit Production: Apples
**CHECKLIST** for grower current practice

1. **ORCHARD ESTABLISHMENT.**
   1.1 I have a whole farm plan? YES NO
   1.2 I have documents, plans, or photographs which show:
      - Location of soil types YES NO
      - Location of wind breaks YES NO
      - prevailing winds YES NO
      - Topography YES NO
      - Erosion control plans YES NO
      - Saline areas YES NO
      - farm tracks YES NO
      - Block location YES NO
      - varieties within blocks YES NO
      - Irrigation lines YES NO
      - dams YES NO
      - Location of buildings including sheds and spray vat filler points YES NO
      - Local council planning permits YES NO
      - Areas of retained natural vegetation YES NO
   1.3 I undertook a site evaluation to determine suitability and limitations of the site prior to planting my last orchard block. YES NO
   1.4 I have documented the site evaluation YES NO
   1.5 I have documented the work done to fix problems identified by the site evaluation YES NO
   1.6 I have documented why I chose the particular combination of planting system, rootstock, and scion varieties YES NO

2. **TREE AND CROP MANAGEMENT.**
   2.1 I have documented my reasons for selecting the training and pruning techniques used for each variety. YES NO
   2.2 Staff involved in tree training and pruning have been given appropriate training in what is required and why YES NO
   2.3 I have documented which staff have been trained in tree training and pruning
   2.4 I regularly assess the results of:
      - Tree training YES NO
      - Pruning YES NO
      - Fertiliser program YES NO
      - Thinning program YES NO
   2.5 I refer back to documented results to help me make decisions on:
      - Tree training YES NO
      - Pruning YES NO
      - Fertiliser YES NO
      - Thinning YES NO
   2.6 My records allow me to relate my tree and crop management practices to harvested yield from each block YES NO

3. **NUTRIENT MANAGEMENT**
   3.1 I do regular tests of soil pH YES NO
   3.2 I monitor pH changes from the surface though to the deeper root zone YES NO
   3.3 I monitor nutrient leakage and run off by:
      - direct measurement YES NO
      - Indirect means such as results from water authorities or land care groups YES NO
   3.4 I base my fertilizer programs on:
      - Soil tests YES NO
      - Fruit tissue analysis YES NO
      - Leaf analysis YES NO
      - Sap analysis YES NO
      - Gut feeling YES NO
      - Crop load YES NO
      - Appearance of the tree YES NO
   3.5 I record all nutrient applications YES NO
3.6 My records include:

<table>
<thead>
<tr>
<th>Material</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The material used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area treated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timing of application</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.7 I use organic manures sometimes

3.8 The organic manures I use have been analyzed for their:

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy metal content</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. IRRIGATION MANAGEMENT

4.1 I test my irrigation water for salinity

4.2 I use irrigation scheduling to manage water use

4.3 To help me schedule my irrigation I use:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensiometers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutron probes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gypsum blocks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporimeter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rainfall gauge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satellites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other(specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.4 I calibrate my sprinklers and drippers

4.5 I keep records of:

<table>
<thead>
<tr>
<th>Record</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprinkler/dripper calibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensiometer readings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutron probe readings/graphs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gypsum block readings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporimeter readings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rainfall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satellite data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timing of irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of irrigation run</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume of water applied</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.6 I have planned my drainage system to fit the local catchment plan

4.7 I have a copy of the local catchment plan

4.8 Staff involved in irrigation scheduling have been trained in:

<table>
<thead>
<tr>
<th>Training</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of monitoring equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpretation of data from monitoring equipment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5 PEST AND DISEASE MANAGEMENT

5.1 I use orchard sanitation and cultural controls to avoid pest and disease build up

5.2 I monitor pest and disease levels in individual blocks within the orchard

5.3 I follow resistance management guidelines

5.4 I select pesticides on the basis of:

<table>
<thead>
<tr>
<th>Basis</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>With holding period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatability with predators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How good a kill they give</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low environmental impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harvest date</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible residues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some one else’s opinion</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.5 I use a consultant to monitor pest and disease levels

5.6 The consultant gives a written report on pest and disease levels
5.7 My own staff do the monitoring | YES | NO
5.8 My own staff record what they find when monitoring | YES | NO
5.9 I base spray decisions on the results of monitoring | YES | NO
5.10 I use a warning service or prediction for:
- Scab | YES | NO
- Codling moth | YES | NO
- LBAM | YES | NO
- Mites | YES | NO
- Dimple bug | YES | NO
- Fruit fly | YES | NO
- Bird control | YES | NO

6 SPRAY APPLICATION
6.1 Staff doing the spraying have a farm chem. Users certificate or equivalent | YES | NO
6.2 I have records of the farm chem. User certificate number and expiry date | YES | NO
6.3 All spray applications are documented | YES | NO
6.4 I document the results of all sprayer calibrations | YES | NO
6.5 My spray operators have access to MSDSs for all chemicals used | YES | NO
6.6 I base spray volume/ha on:
- Trees row volume | YES | NO
- Vat size | YES | NO
- What my neighbors use | YES | NO
- The sprayer manufacturer’s guidelines | YES | NO
- The pesticide label | YES | NO
- Consultant/ reseller advice | YES | NO
- What the previous owner did | YES | NO
- Experience | YES | NO

7 HARVEST STORAGE and PACKAGING
7.1 I have a HACCP based accreditation for the packing shed | YES | NO
7.2 I Harvest based on:
- Availability of pickers | YES | NO
- Starch tests | YES | NO
- Sugar levels | YES | NO
- Pressure test | YES | NO
- Color | YES | NO
- With holding period of chemicals used | YES | NO
- When I picked last year | YES | NO
- When everyone else starts | YES | NO
- Other(specify) | YES | NO

7.3 I provide field toilets for pickers | YES | NO
7.4 I provide access to toilets for pickers | YES | NO
7.5 Toilets have hand washing facilities | YES | NO
7.6 I have policies in place for:
- Blood spill | YES | NO
- Use of personal hygiene | YES | NO
- Glass breakage | YES | NO
- Vermin control | YES | NO

7.7 I document employee training/ awareness of my polices | YES | NO
7.8 Spore loads in water dumps and dip tanks are monitored regularly | YES | NO
7.9 Chemical concentrations in water dumps and dip tanks are monitored:
- Before use | YES | NO
- During use | YES | NO
- Before topping up | YES | NO
- After topping up | YES | NO

7.10 I have measured the volume of my water dump | YES | NO
7.11 I have measured the volume of my dip tank | YES | NO
7.12 I have a copy of the current customer specifications | YES | NO
Appendix 3
Results of survey of grower current practices
<table>
<thead>
<tr>
<th><strong>Percentage of growers answering “yes” to questions on current practice</strong></th>
<th><strong>&quot;Yes&quot;</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ORCHARD ESTABLISHMENT</strong></td>
<td></td>
</tr>
<tr>
<td>I have a whole farm plan</td>
<td>42.9%</td>
</tr>
<tr>
<td>I have documents, plans, or photographs which show:</td>
<td></td>
</tr>
<tr>
<td>Location of soil types</td>
<td>32.7%</td>
</tr>
<tr>
<td>Location of wind breaks</td>
<td>49.0%</td>
</tr>
<tr>
<td>Prevailing winds</td>
<td>32.7%</td>
</tr>
<tr>
<td>Topography</td>
<td>40.8%</td>
</tr>
<tr>
<td>Erosion control plans</td>
<td>20.4%</td>
</tr>
<tr>
<td>Saline areas</td>
<td>20.4%</td>
</tr>
<tr>
<td>Farm tracks</td>
<td>69.4%</td>
</tr>
<tr>
<td>Block location</td>
<td>85.7%</td>
</tr>
<tr>
<td>Varieties within blocks</td>
<td>75.5%</td>
</tr>
<tr>
<td>Irrigation lines</td>
<td>79.6%</td>
</tr>
<tr>
<td>Dams</td>
<td>83.7%</td>
</tr>
<tr>
<td>Location of buildings incl. sheds and spay vat filler points</td>
<td>69.4%</td>
</tr>
<tr>
<td>Local council planning permits</td>
<td>44.9%</td>
</tr>
<tr>
<td>Areas of retained natural vegetation</td>
<td>42.9%</td>
</tr>
<tr>
<td>I undertook a site evaluation to determine suitability and limitations of the site prior to planting my last orchard block</td>
<td>67.3%</td>
</tr>
<tr>
<td>I have documented the site evaluation</td>
<td>30.6%</td>
</tr>
<tr>
<td>I have documented the work done to fix problems identified by the site evaluation</td>
<td>32.7%</td>
</tr>
<tr>
<td>I have documented why I chose the particular combination of planting system, rootstock, and scion varieties</td>
<td>22.4%</td>
</tr>
<tr>
<td><strong>TREE AND CROP MANAGEMENT</strong></td>
<td></td>
</tr>
<tr>
<td>I have documented my reasons for selecting the training and pruning techniques used for each variety</td>
<td>22.4%</td>
</tr>
<tr>
<td>Staff involved in tree training and pruning have been given appropriate training in what is required and why</td>
<td>81.6%</td>
</tr>
<tr>
<td>I have documented which staff have been trained in tree training and pruning</td>
<td>12.2%</td>
</tr>
<tr>
<td>I regularly assess the results of:</td>
<td></td>
</tr>
<tr>
<td>Tree training</td>
<td>81.6%</td>
</tr>
<tr>
<td>Pruning</td>
<td>85.7%</td>
</tr>
<tr>
<td>Fertiliser program</td>
<td>79.6%</td>
</tr>
<tr>
<td>Thinning program</td>
<td>81.6%</td>
</tr>
<tr>
<td>I refer back to documented results to help me make decisions on:</td>
<td></td>
</tr>
<tr>
<td>Tree training</td>
<td>42.9%</td>
</tr>
<tr>
<td>Pruning</td>
<td>46.9%</td>
</tr>
<tr>
<td>Fertiliser</td>
<td>73.5%</td>
</tr>
<tr>
<td>Thinning</td>
<td>63.3%</td>
</tr>
<tr>
<td>My records allow me to relate my tree and crop management practices to harvested yield from each block</td>
<td>65.3%</td>
</tr>
<tr>
<td><strong>NUTRIENT MANAGEMENT</strong></td>
<td></td>
</tr>
<tr>
<td>I do regular test of soil ph</td>
<td>85.7%</td>
</tr>
<tr>
<td>I monitor ph changes from the surface through to the deeper root zone</td>
<td>53.1%</td>
</tr>
<tr>
<td>I monitor nutrient leaching and run off by Direct measurement</td>
<td>10.2%</td>
</tr>
<tr>
<td>Indirectly(e.g. results from water authorities or land care groups)</td>
<td>10.2%</td>
</tr>
<tr>
<td>I base my fertiliser programs on:</td>
<td></td>
</tr>
<tr>
<td>soil tests</td>
<td>89.8%</td>
</tr>
<tr>
<td>Fruit tissue analysis</td>
<td>34.7%</td>
</tr>
<tr>
<td>leaf analysis</td>
<td>89.8%</td>
</tr>
<tr>
<td>sap analysis</td>
<td>10.2%</td>
</tr>
<tr>
<td>Gut feeling</td>
<td>36.7%</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Crop load</td>
<td>67.3%</td>
</tr>
<tr>
<td>Appearance of the tree</td>
<td>81.6%</td>
</tr>
<tr>
<td>I record all nutrient applications</td>
<td>81.6%</td>
</tr>
<tr>
<td>My records include:</td>
<td></td>
</tr>
<tr>
<td>The material used</td>
<td>91.8%</td>
</tr>
<tr>
<td>Quantity used</td>
<td>87.8%</td>
</tr>
<tr>
<td>Area treated</td>
<td>89.8%</td>
</tr>
<tr>
<td>Method of application</td>
<td>73.5%</td>
</tr>
<tr>
<td>Timing of application</td>
<td>87.8%</td>
</tr>
<tr>
<td>I use organic manure sometimes</td>
<td>55.1%</td>
</tr>
<tr>
<td>The organic manure I use have been analyzed for their:</td>
<td></td>
</tr>
<tr>
<td>Nutrient content</td>
<td>44.9%</td>
</tr>
<tr>
<td>Heavy metal content</td>
<td>20.4%</td>
</tr>
</tbody>
</table>

**IRRIGATION MANAGEMENT**

<table>
<thead>
<tr>
<th>I test my irrigation water for salinity</th>
<th>34.7%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I use irrigation scheduling to manage water use</td>
<td>63.3%</td>
</tr>
<tr>
<td>To help me schedule my irrigation I use:</td>
<td></td>
</tr>
<tr>
<td>Tensiometers</td>
<td>36.7%</td>
</tr>
<tr>
<td>Neutron probes</td>
<td>26.5%</td>
</tr>
<tr>
<td>Gypsum blocks</td>
<td>8.2%</td>
</tr>
<tr>
<td>Evaporimeter</td>
<td>8.2%</td>
</tr>
<tr>
<td>Rainfall</td>
<td>63.3%</td>
</tr>
<tr>
<td>Satellites</td>
<td>4.1%</td>
</tr>
<tr>
<td>Other</td>
<td>16.3%</td>
</tr>
</tbody>
</table>

| I calibrate my sprinklers and drippers | 44.9% |
| I keep records of:                    |       |
| Sprinkler/dripper calibration         | 16.3% |
| Tensiometer readings                  | 20.4% |
| Neutron probe readings / graphs       | 26.5% |
| Gypsum block readings                 | 8.2%  |
| Evaporimeter readings                 | 8.2%  |
| Rainfall                               | 63.3% |
| Satellite data                        | 4.1%  |
| Salinity                               | 16.3% |
| Water table                            | 14.3% |
| Timing of irrigation                   | 67.3% |
| Length of irrigation run               | 57.1% |
| Volume of water applied                | 42.9% |
| I have planned my drainage system to fit the local catchment plan | 26.5% |
| I have a copy of the local catchment plan | 8.2% |
| Staff involved in irrigation scheduling have been trained in: |       |
| The use of monitoring equipment        | 44.9% |
| Interpretation of data from monitoring equipment | 36.7% |

**PEST AND DISEASE MANAGEMENT**

<p>| I use orchard sanitation and cultural controls to avoid pest and disease build up | 87.8% |
| I monitor pest and disease level in individual blocks within the orchard | 87.8% |
| I follow resistance management guidelines | 89.8% |
| I select pesticides on the basis of: |       |
| Withholding period                     | 93.9% |
| Compatibility with predators           | 85.7% |
| How good a kill they give              | 83.7% |
| Low environmental impact               | 81.6% |
| Harvest date                           | 91.8% |
| Operator safety                        | 89.8% |</p>
<table>
<thead>
<tr>
<th>Possible residues</th>
<th>77.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>81.6%</td>
</tr>
<tr>
<td>Ease of application</td>
<td>87.8%</td>
</tr>
<tr>
<td>someone else's opinion</td>
<td>46.9%</td>
</tr>
</tbody>
</table>

| I use a consultant to monitor pest and disease levels | 57.1% |
| The consultant gives a written report on pest and disease levels | 49.0% |
| My own staff do the monitoring | 44.9% |
| My own staff record what they find when monitoring | 34.7% |
| I base spray decisions on the results of monitoring | 91.8% |
| I use a warning service or prediction for: | |
| Scab | 46.9% |
| Codling moth | 55.1% |
| LBAM | 24.5% |
| Mites | 36.7% |
| Dimple bug | 30.6% |
| Fruit fly | 16.3% |
| Bird control | 4.1% |

**SPRAY APPLICATION**

- Staff doing the spraying have a Farm Chemical Users Certificate or equivalent | 81.6% |
- I have records of the Farm Chemical Users Certificate number and expiry date | 71.4% |
- All spray applications are documented | 91.8% |
- I document the results of all sprayer calibrations | 71.4% |
- My spray operators have access to MSDSs for all chemicals used | 55.1% |
- I base spray volume/ha on: |
  - Tree row volume | 61.2% |
  - Vat size | 49.0% |
  - What my neighbours use | 2.0% |
  - The sprayer manufacturer's guidelines | 42.9% |
  - The pesticide label | 91.8% |
  - Consultant/reseller advice | 63.3% |
  - What the previous owner did | 4.1% |
- Experience | 81.6% |

**HARVEST, STORAGE AND PACKAGING**

- I have a HACCP based accreditation for the packing shed | 40.8% |
- I harvest based on: |
  - Availability of pickers | 30.6% |
  - Starch tests | 65.3% |
  - sugar levels | 75.5% |
  - Pressure test | 59.2% |
  - Color | 87.8% |
  - Withholding period of chemicals used | 81.6% |
  - When I picked last year | 18.4% |
  - When everyone else starts | 4.1% |
  - Other | 20.4% |
- I provide field toilets for pickers | 49.0% |
- I provide access to toilets for pickers | 87.8% |
- Toilets have hand washing facilities | 89.8% |
- I have policies in place for: |
  - Blood spill | 24.5% |
  - Use of personal hygiene | 46.9% |
  - Glass breakage | 28.6% |
  - Vermin control | 55.1% |
- I document employee training/ awareness of my policies | 34.7% |
- Spore loads in water dumps and dip tanks are monitored regularly | 36.7% |
- Chemical concentrations in water dumps and dip tanks are monitored: |
  - Before use | 38.8% |
<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>During use</td>
<td>44.9%</td>
</tr>
<tr>
<td>Before topping up</td>
<td>36.7%</td>
</tr>
<tr>
<td>After topping up</td>
<td>34.7%</td>
</tr>
<tr>
<td>I have measured the volume of my water dump</td>
<td>51.0%</td>
</tr>
<tr>
<td>I have measured the volume of my dip tank</td>
<td>59.2%</td>
</tr>
<tr>
<td>I have a copy of the current customer specifications</td>
<td>32.7%</td>
</tr>
</tbody>
</table>
Appendix 4
National Guidelines for Integrated Fruit Production
AUSTRALIAN NATIONAL GUIDELINES FOR INTEGRATED FRUIT PRODUCTION: APPLES

2000
INTEGRATED FRUIT PRODUCTION FOR THE AUSTRALIAN APPLE INDUSTRY

INTRODUCTION

The Australian Apple Industry wishes to implement a continuously improving Integrated Fruit Production program that follows the general principles of International programs as defined by –

The economical production of high quality fruit, giving priority to ecologically safer methods, minimising the undesirable side effects and use of agrochemicals, to enhance the safeguards to the environment and human health. (International Organisation for Biological and Integrated Control of Noxious Animals and Plants (IOBC) and International Society for Horticultural Science (ISHS) Working Party on Integrated Fruit Production, 1998).

The program is being implemented because the Apple Industry has a desire to operate in an economically and environmentally sustainable manner. To achieve this, it is recognized that there is a need for efficient use of resources; minimum pollution and degradation of the environment; and high standards of safety for both participants in the industry and consumers of the fruit produced.

The Australian Apple and Pear Growers Association (AAPGA) and the Horticultural Research and Development Corporation (HRDC) commissioned David Williams from the Department of Natural Resources and Environment in the State of Victoria to develop National Guidelines for IFP for Apples in Australia. Mr. Williams assembled a project team that involved a technical panel of orchardists, R&D providers, agrochemical industry representatives, consultants and marketers. The Australian Fresh Fruit Company (AFFCo) provided additional funding and an export focus. The first draft of the Guidelines was modified after comments from European experts on IFP, and feedback from British importers of Australian fruit, as well as growers and Departments of Agriculture in all apple growing States in Australia.

This document outlines the general principles and strategies to be used in Integrated Fruit Production (IFP) and has been developed with consideration of the following:

• Geographically, Australia is a large country and apples are produced in regions that may be many thousands of kilometres apart and which have large differences in both climate and soil types available. While this does not alter any of the principles it does limit the usefulness of making very prescriptive rules for using the resources available and required in different regions;

• Many apple producers in Australia have already adopted Quality Assurance (QA) Programs and it is desirable that the IFP and QA programs are compatible and complementary. QA programs will be given the opportunity to incorporate the necessary IFP principles so that the QA audit will cover both QA and IFP. This will reduce the amount of paperwork and cost of complying with IFP.

• These Guidelines represent the minimum requirements for IFP in Australia. Resource manuals and other technical information that allow the development of more prescriptive regional guidelines will be developed after the National Guidelines are accepted by the Australian apple industry.
Orchard Establishment

Principles

The design and establishment of orchards uses appropriate planning, planting and management practices, resulting in profitable and sustainable orchards that do not degrade the site and which minimize the potential for any harm to the surrounding environment and community.

Strategy

Site selection and management decisions give careful consideration to maintaining or increasing the biodiversity of the area and the quality of water in surrounding waterways. They also protect soil structure and minimize the requirement for chemical usage.

More specifically, this includes:

- Encouraging the use of Property Management Planning/Farming for the future principles;
- Developing a Whole Farm Plan which includes siting of windbreaks, areas of natural vegetation, drainage lines and waterways, sensitive areas, block and variety locations, man-made structures, tracks, and the irrigation system;
- Planning that allows adequate time to order appropriate planting material and to undertake necessary site works;
- Selecting an appropriate planting system after consideration of factors including soil fertility and drainage, site characteristics, variety, available rootstock, the most efficient irrigation system, proposed spacing and training support system and row orientation;
- Encouraging retention of natural vegetation or revegetation for the enhancement of the natural environment and climate protection of the local area;
- Siting of man-made structures according to local planning guidelines/regulations and to minimize any impact on local waterways, neighbouring properties and plant communities;
- Carrying out soil analyses to determine soil fertility and any limitations;
- Using fumigation or other chemical control of soil borne pathogens, nematodes or specific replant disease only when the results of bioassays or scientific tests indicate a need;
- Using an orchard sward, wherever practical, to minimize soil compaction and dust contamination, assist in weed control and maintain biological diversity in the orchard to enhance beneficial predators.

Actions

In order to achieve the desired outcomes, the following need to be adopted:

- Undertake a site evaluation to determine suitability and limitations of the site;
- Ameliorate soil limitations such as compaction, drainage, waterlogging, salinity, pH, nutrient imbalances;
- Maintain a record of work done, tests conducted and any chemical treatments applied;
- Establish and manage the planting according to the above principles and strategy.
Tree and Crop Management

Principles

Tree and crop management uses continuous improvement to grow trees of the desired size that produce economic yields of good quality fruit and allow effective use of labour and use levels of other inputs that have minimum effect on the environment.

Strategy

Decisions taken to manage tree structure, size and cropping are based on prior experience on the site and/or current observations to produce open structured trees that allow light and spray penetration, efficient use of harvest labour, minimal fruit damage and where consistent yields regulate tree growth.

More specifically, this includes:

• Encouraging the use of appropriate rootstock/variety combinations for the site as they become available;
• Using appropriate training and pruning techniques to optimize the selected growing system;
• Adopting nutrition and irrigation strategies as outlined in other chapters;
• Giving preference to cultural methods such as rootstock selection, management of crop load, reducing or improving the timing of fertilizer application, regulated deficit irrigation, cincturing and increased floor competition to limit any excess tree vigour;
• Applying plant bio-regulators to control excess vigour only when other methods have not achieved satisfactory growth control and economic production;
• Controlling excessive fruit set with the use of appropriate recommended thinning programs using registered plant bio-regulators;
• If necessary, reducing extended flowering periods with the use of appropriate registered plant bio-regulators to break dormancy and achieve satisfactory crops to control tree growth.

Actions

In order to achieve the desired outcomes the following need to be adopted:

• Provide appropriate training to staff who are involved in tree training and pruning;
• Base management decisions on any available prior records and observation of current seasonal conditions;
• Ensure that operations are timed to be most effective;
• Maintain appropriate records which should include the type and timing of any management treatments, the observed response and the harvested yield from each block.
Nutrient Management

Principle

Optimize the production of quality fruit by monitoring and applying nutrients efficiently, according to need, while minimizing any environmental impact.

Strategy

Decisions for nutrient application are based on the monitored crop requirements. Applications use techniques that minimize off-site movement and soil degradation. Nutrient management will be continuously reviewed and improved.

More specifically, this includes:

- Develop nutrient management programs based on historical records, orchard performance and appropriate interpretation of soil, fruit and plant tissue data;
- Tailor applications to needs of individual blocks or soil types;
- Provision of appropriate training packages or information to enable growers to make more informed decisions and continuously improve nutrient management;
- Consider use of split applications to minimize any off-site movement;
- Selection of appropriate application methods which maximise efficiency and minimise problems with excessive vigour or environmental contamination;
- Monitoring of off-target nutrient concentration e.g. groundwater, run-off;
- Test organic manures to determine nutrient content and ensure that any heavy metals are not at problem levels;

Actions

In order to achieve the desired outcomes, the following need to be adopted:

- Regular soil, fruit and plant tissue analysis;
- Apply nutrients according to above principles and strategies;
- Record nutrient applications. Records will include the material and quantity used and both the method and timing of application.
Irrigation Management

Principle
Water is a scarce resource in Australia. It must be used efficiently, effectively and monitored to optimize fruit production and quality with due consideration to the environment.

Strategy
Irrigation management decisions are based on water availability, quality and appropriate application methods to optimize productivity and water use efficiency.

More specifically, this includes:

• Scheduling irrigation on the basis of accepted methods such as evapotranspiration or soil moisture deficits;
• Adopt irrigation practices and cultural practices that optimize water infiltration and enhance orchard floor management;
• Irrigate applied nutrients to ensure that nutrients remain in the rootzone of the trees;
• Recycle any irrigation run-off in situations where this is practical.

Actions
In order to achieve the desired outcomes, the following need to be adopted:

• Provide managers with appropriate training to better understand irrigation scheduling and management;

• Monitor and record important aspects of irrigation. This will include water quality, methods and rates of application and the timing of applications in relation to scheduling and rainfall events;

• Irrigate according to above principles.
Integrated Pest, Disease and Weed Management

Principles

In this document the definition of pest includes all pest animals (vertebrate and invertebrate), disease-causing agents (bacteria, fungi, viruses, etc.) and weeds. Integrated pest management (IPM) uses and encourages continual improvement in pest control measures that have minimal impact on the environment and human health and which promote sustainability and profitability for all participants in the value chain and the community.

Strategy

Decisions taken for minimizing the risk of pest damage depend on integrating information on pest life cycles, the pest-beneficial balance, impact of cultural conditions, pest action threshold, likely effectiveness of the control measure, weather conditions, environmental impact, requirements of the community and consumer preference.

More specifically, this includes:

- Carrying out best practice for orchard sanitation and cultural control that removes sources of infection/infestation and avoids pest build-up;
- Implementing practices such as sward cover, or buffer trees that conserve beneficials in the orchard;
- Identifying problem areas in the orchard as both an indicator of a possible problem in the whole orchard, and as a target for specific control;
- Giving preference to methods that are pest-specific and least hazardous to the environment and human health;
- Using regionally-based, pest specific action thresholds; recording the decision whether to use a pest control measure or not; noting the pest control measure and the target, and subsequently evaluating the results of the treatment;
- Compliance with pest resistance management guidelines, as stated by government authorities, grower organizations, pesticide labels and other material provided by manufacturers;
- Selecting pesticides based on consideration of residues, withholding period, harvest date, compatibility with biological control methods, efficacy, minimal impact on the environment and safety for orchard staff;
- Observing all label requirements for chemicals where it may be necessary to use them, especially the withholding period; and
- Discouraging routine chemical applications except where there is such a risk of latent infection or infestation that preventative measures may be the only practical approach to minimize overall chemical usage.

Actions

In order to achieve these outcomes, the following need to be adopted:

- Effective and ongoing training;
- Carry out appropriate monitoring of pests and beneficial organisms;
- If pesticides are required, select them according to the above strategies and ensure their use will not contravene the requirements of the target market;
- Recording all the elements that contribute to making a good pest management decision, following good spray application guidelines;
- Treatment according to the above principles;
Spray Application

Principles

Pesticides, bio-regulators and nutrients should be applied efficiently taking into consideration; efficacy, energy conservation, avoidance of drift and safety of operators, consumers and the environment.

Strategy

Decisions to spray are based on results of monitoring or tests that support the need for a spray application. In order to achieve the general principles the strategy should include:

- Using tree volume calculations or documented calibration-sprays as the basis for establishing dilute water volume for foliar applications;
- Dilute water volume should be used for determining the correct dose rate (Rate/ha);
- Selecting weather conditions and crop stage to maximize product efficiency and minimize environmental impact (drift);
- Calibrating and maintaining equipment in optimum working condition for efficient application;
- Training and equipping spray operators;
- Minimizing any contamination of the general environment;

Actions

In order to achieve the desired outcomes, the following need to be adopted:

- All operators will have successfully completed an approved Farm Chemical Users Course or have been given other training which allowed them to demonstrate their competency;
- Appropriate protective clothing and equipment must be used and closed filling systems should be considered;
- Record all spray applications in appropriate format;
- Calibrate and service equipment at least annually or more frequently dependent on manufacturers guidelines and recorded use;
- Orchard filling and washdown areas should be located to minimize the risk of environmental contamination;
- Pesticide containers should be disposed of according to Avcare guidelines.
Management of Harvest, Storage and Packaging

Principles

Encourages best practice in harvesting, handling, storing and packing of fruit in conjunction with Quality Assurance procedures to present consumers with high quality fruit that is safe for human consumption.

Strategy

Decisions taken to maintain fruit quality and safety integrate information on fruit maturity, available storage technology, predicted susceptibility of fruit to disorders and the effectiveness of proposed control measures considering environmental impact and consumer preference.

More specifically, this includes:

- Basing harvest timing on results of objective measures of fruit maturity;
- Implementing a policy of no animals in the storage and packing facility;
- Implement vermin and bird control procedures;
- Providing appropriate, clean outer-garments for use by employees in the packing facility;
- Monitoring water quality, pH and levels of any additives used in water dumps or dips;
- Implementing a policy to handle the possibility of a glass breakage or blood spill in the packing facility;
- Providing suitable facilities, such as lunch area and toilets with appropriate hand washing facilities, for employees;
- Having a policy of no eating or smoking in the packing facility;
- Using information on the susceptibility of a variety to a disorder or rot, the intended storage conditions, the intended storage period and any recent field sprays to determine the need to apply any postharvest chemical;
- Observing all label requirements for chemicals where it may be necessary to use them;
- Scheduling regular cleaning of the packing area and an annual cleaning of coolrooms to reduce spore loads;
- Disposing of used dips and waste fruit in the recommended manner; and
- Carrying out regular maintenance of plant to ensure energy efficient operation of coolstores

Actions

In order to achieve the desired outcomes, the following need to be adopted:

- Provide appropriate training on policy to employees;
- Maintain records of all operations;
- Conduct operations according to above principles, preferably under an accredited Quality Assurance Scheme.
Appendix 5
Comparison of Australian Apple IFP Guidelines against EUREP guidelines.
To: David.Williams@nre.vic.gov.au
cc: Denise.Field@tao.sainsburys.co.uk (bcc: David Williams/NRE)
Subject: EUREP and ICM

Dear David

Ian Finalyson has asked me to forward a copy of the EUREP GAP to you. Attached is a file containing the EUREP guidelines. Also I have compiled a table comparing the IFP guidelines and EUREP and would be very interested to receive your comments on this. This is also attached as a file.

If you wish to discuss any of this please do not hesitate to contact me.

Regards

Denise Field

Comparison table for EUREP and Australian National Guidelines for Integrated Fruit Production Apples

<table>
<thead>
<tr>
<th>EUREP (European wide) - all produce</th>
<th>Guidelines for IFP Fruit Production - Apples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good agricultural practice - all products</td>
<td></td>
</tr>
</tbody>
</table>

**MISSION STATEMENT**

**INTRODUCTION:** Scope
Sets out framework for GAP
**INTRODUCTION:** General principles and considerations, background to development

**RECORD KEEPING**
To demonstrate GAP compliance (no specifics)

**VARIETIES AND ROOTSTOCKS:**
Choice of
Seed Quality
Pest and disease resistance
Seed treatments and dressings
Nursery stock
GMO
**Tree and Crop Management:**
Use of appropriate rootstock/variety combinations

**SITE HISTORY AND SITE MANAGEMENT:**
Site history
Rotations
**Orchard Establishment:**
Principles
Site selection
Planning
Planting systems

34
<table>
<thead>
<tr>
<th>SOIL AND SUBSTRATE MANAGEMENT:</th>
<th>Orchard Establishment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil mapping</td>
<td>Soil analysis to determine fertility and any limitations</td>
</tr>
<tr>
<td>Cultivations</td>
<td>Control of soil borne pathogens (fumigation/chemical) only when proven necessary</td>
</tr>
<tr>
<td>Soil erosion</td>
<td>Use orchard sward to minimise compaction, dust contamination and assist weed control, and to enhance beneficial predators</td>
</tr>
<tr>
<td>SOIL FUMIGATION</td>
<td>Site evaluation</td>
</tr>
<tr>
<td>Substrates (content to be agreed '99)</td>
<td>Ameliorate limitations</td>
</tr>
<tr>
<td></td>
<td>Maintain full records</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FERTILISER USAGE:</th>
<th>Nutrient Management:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient requirement</td>
<td>Minimise off site movement and soil degradation</td>
</tr>
<tr>
<td>Advice on quantity/type</td>
<td>Continuous review and monitoring</td>
</tr>
<tr>
<td>Records of application</td>
<td>Management programs based on historic data, performance and data interpretation</td>
</tr>
<tr>
<td>Timing and frequency of application</td>
<td>Tailor applications to blocks and soil types</td>
</tr>
<tr>
<td>Nitrate and Phosphorous levels in ground water</td>
<td>Appropriate training and information availability</td>
</tr>
<tr>
<td>Application machinery</td>
<td>Consider split applications to minimise movement</td>
</tr>
<tr>
<td>Fertiliser storage</td>
<td>Monitor off-target nutrient concentrations</td>
</tr>
<tr>
<td>Organic manure</td>
<td>Test organic manures (heavy metals)</td>
</tr>
<tr>
<td></td>
<td>Regular soil, fruit and plant tissue analysis</td>
</tr>
<tr>
<td></td>
<td>Record applications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IRRIGATION:</th>
<th>Irrigation Management:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicting requirement</td>
<td>Optimise productivity and water use efficiency</td>
</tr>
<tr>
<td>Method</td>
<td>Scheduling based on accepted methods</td>
</tr>
<tr>
<td>Quality of water</td>
<td>Optimise water infiltration and enhance orchard floor management</td>
</tr>
<tr>
<td>Supply</td>
<td>Nutrient application to remain within root zone</td>
</tr>
<tr>
<td></td>
<td>Recycle irrigation run off</td>
</tr>
<tr>
<td></td>
<td>Appropriate training</td>
</tr>
<tr>
<td></td>
<td>Monitor and record important aspects</td>
</tr>
<tr>
<td>CROP PROTECTION:</td>
<td>Tree and Crop Management:</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>Basic elements of crop protection</td>
<td>Use appropriate training and pruning techniques</td>
</tr>
<tr>
<td>Prevention - indirect measures</td>
<td>Preference to reduced fertiliser application, regulated</td>
</tr>
<tr>
<td>Observation</td>
<td>deficit irrigation, cincturing, and increased floor</td>
</tr>
<tr>
<td>Intervention</td>
<td>competition</td>
</tr>
<tr>
<td>IPM systems</td>
<td>Plant bioregulators to control excess vigour only</td>
</tr>
<tr>
<td>Choice of chemicals</td>
<td>when other methods fail</td>
</tr>
<tr>
<td>Observation</td>
<td>Control excess fruit and through thinning using</td>
</tr>
<tr>
<td>Intervention</td>
<td>registered bioregulators</td>
</tr>
<tr>
<td>IPM systems</td>
<td>Reduce flowering periods using registered</td>
</tr>
<tr>
<td>Choice of chemicals</td>
<td>bioregulators</td>
</tr>
<tr>
<td>Advice on quantity and type</td>
<td>Provide appropriate training</td>
</tr>
<tr>
<td>Records of application</td>
<td>Decisions based on prior records</td>
</tr>
<tr>
<td>Safety, training and instructions</td>
<td>Ensure optimal timing of operations</td>
</tr>
<tr>
<td>Protective clothing</td>
<td>Maintain records</td>
</tr>
<tr>
<td>Pre harvest interval</td>
<td>Integrated Pest Management:</td>
</tr>
<tr>
<td>Spray equipment</td>
<td>Best practice for orchard sanitation and cultural</td>
</tr>
<tr>
<td>Disposal of Surplus Spray mix</td>
<td>control</td>
</tr>
<tr>
<td>Pesticide residue analysis</td>
<td>Implement sward cover, buffer trees to conserve</td>
</tr>
<tr>
<td>Pesticide storage</td>
<td>beneficials</td>
</tr>
<tr>
<td>Empty pesticide containers</td>
<td>Identify problem areas as both indicators of problems</td>
</tr>
<tr>
<td>Obsolete pesticides</td>
<td>and target areas for treatment</td>
</tr>
<tr>
<td></td>
<td>Preference to methods that are pest specific and</td>
</tr>
<tr>
<td></td>
<td>least hazardous to environment and human health</td>
</tr>
<tr>
<td></td>
<td>Use regionally based, pest specific action</td>
</tr>
<tr>
<td></td>
<td>thresholds - fully record</td>
</tr>
<tr>
<td></td>
<td>Compliance with pest resistance management</td>
</tr>
<tr>
<td></td>
<td>guidelines</td>
</tr>
<tr>
<td></td>
<td>Careful consideration to chemical selection (residue</td>
</tr>
<tr>
<td></td>
<td>levels, with holding period etc.)</td>
</tr>
<tr>
<td></td>
<td>Observe all label requirements</td>
</tr>
<tr>
<td></td>
<td>Discourage routine applications</td>
</tr>
<tr>
<td></td>
<td>Effective ongoing training</td>
</tr>
<tr>
<td></td>
<td>Monitoring of pests and beneficial organisms</td>
</tr>
<tr>
<td></td>
<td>Record all elements</td>
</tr>
<tr>
<td>Spray application:</td>
<td>Spray decisions based on monitoring and tests</td>
</tr>
<tr>
<td></td>
<td>Tree volume as basis for dilute water volume for foliar</td>
</tr>
<tr>
<td></td>
<td>applications</td>
</tr>
<tr>
<td></td>
<td>Dilute water volume will determine dose rate</td>
</tr>
<tr>
<td></td>
<td>Optimum weather conditions and crop stage</td>
</tr>
<tr>
<td></td>
<td>Maintain equipment</td>
</tr>
<tr>
<td></td>
<td>Train and equip spray operators</td>
</tr>
<tr>
<td></td>
<td>Minimise contamination of environment</td>
</tr>
<tr>
<td></td>
<td>Adequate training - approved course</td>
</tr>
<tr>
<td></td>
<td>Appropriate clothing</td>
</tr>
<tr>
<td></td>
<td>Record all applications</td>
</tr>
<tr>
<td></td>
<td>Calibrate and service equipment annually</td>
</tr>
<tr>
<td></td>
<td>Minimise contamination from orchard filling and</td>
</tr>
<tr>
<td></td>
<td>washdown</td>
</tr>
<tr>
<td></td>
<td>Container disposal according to Avicare guidelines</td>
</tr>
</tbody>
</table>

36
| HARVESTING: | Harvest, Storage and Packaging: |
| Hygiene | Harvest timing based on fruit maturity |
| Adequate toilet/washing facilities | No animals in storing and packing facility |
| Packaging | Suitable, laundered clothing |
| Monitor water quality | Implement policy for glass break and blood spill |
| Provide lunch room and toilets | No eating or smoking in packhouse |
| Careful consideration of post harvest chemical use | Observe all label requirements on chemicals |
| Regularly clean packhouse, clean coolrooms annually | Dispose of dips and waste fruit in recommended manner |
| Carry out regular maintenance of plant | Maintain records |

| POST HARVEST TREATMENTS: | |
| Post harvest chemicals | |
| Post harvest washing | |

| WASTE AND POLLUTION MANAGEMENT, RECYCLING AND REUSE: | |
| Identification of waste and pollutants | |
| Waste and pollution action plan. | |

| WORKER HEALTH, SAFETY AND WELFARE: | |
| Training | |
| Facilities and Equipment | |
| Pesticide Handling | |
| Hygiene | |
| Welfare | |

| ENVIRONMENTAL ISSUES: | Orchard Establishment: |
| Impact of Farming | Refers to "careful consideration" to biodiversity and water quality |
| Wildlife and conservation policy | Retention of natural vegetation and enhancement |
| Key elements | |
| Unproductive sites | |

| INSPECTION: | TBC |
The Euro Retailer Group (EUREP) which represents the leading European Food retailers, have agreed to accept and promote the Good Agricultural Practice (GAP) standards as outlined in this protocol. This is in response to increasing consumer interest on the impact of agriculture on food safety and the environment, and reflects a desire to further improve the standards of production in co-operation with our suppliers.

MISSION STATEMENT

It is important that Growers of Horticultural Products focus on continuous progressive improvement of their management and production practices to support continued customer confidence.

All growers should be able to demonstrate their commitment to:
- maintaining consumer confidence in food quality and safety;
- minimise detrimental impact on the environment, whilst conserving nature and wildlife;
- reduce the use of agrochemicals through adoption of Integrated Production systems;
- improve efficiency of use of natural resources such as soil, water, air and energy;
- ensure a responsible attitude to worker health and safety, welfare and training.

CONTENTS

1. Introduction
2. Record Keeping
3. Varieties and Rootstocks
4. Site History and Site Management
5. Soil and Substrate Management
6. Fertiliser Usage
7. Irrigation
8. Crop Protection
9. Harvesting
10. Post-Harvest Treatments
11. Waste and Pollution Management, Recycling and Reuse
12. Worker Health, Safety and Welfare
13. Environmental Issues

1. INTRODUCTION

Scope
This document sets out a framework for Good Agricultural Practice (GAP) which defines essential elements and developing best-practice for the global production of Horticultural products (fruit, vegetables, salads, cut flowers and nurseries stock). It defines the minimum standard acceptable to the leading retail groups in Europe, however standards for some individual retailers and those adopted by some growers may exceed those described.

EUREP members wish to recognise the significant progress already made by many growers, grower groups, local and national schemes in developing and implementing best-practice agricultural systems with the aim of minimising adverse impact on the environment. EUREP members also wish to encourage further work to improve growers capability in this area, and in this respect this GAP framework which defines the key elements of current agricultural best-practice should be used as a benchmark to assess current practice, and provide guidance for further development.

GAP is a means to incorporate Integrated Pest Management (IPM) and Integrated Crop Management (ICM) practices within the framework of commercial agricultural production.
Adoption of IPM/ICM is regarded by EUREP members as essential for the long-term improvement of horticultural production.

It is essential that all organisations involved in the food chain accept their share of the tasks and responsibilities to ensure that GAP is fully implemented and supported. If consumer confidence in fresh produce is to be maintained, such standards of good agricultural practice must be adopted, and examples of poor practice must be eliminated from the industry.

2. RECORD-KEEPING

Growers must keep records to demonstrate that all activities of production comply with GAP as outlined in this document, and which can help to trace the history of products from the farm to the final consumer.

3. VARIETIES AND ROOTSTOCKS

a. Choice of Variety or Rootstock:
Choice of variety or rootstock must meet the specified requirement as agreed between growers and potential customers in respect of quality standards, taste, visual appearance, shelf-life, agronomic performance and minimum dependence on agrochemicals. Growers should be aware of the importance of effective crop husbandry in relation to 'mother crops' (e.g. in the production of seed potatoes), where beneficial results (such as a reduction in pesticide use) may be experienced in subsequent crops.

b. Seed Quality:
Seed quality and germination rate must be checked before use. A record must be kept in a crop diary of the variety name, batch number and seed vendor.

c. Pest and Disease Resistance:
Growers must be aware of the degree of susceptibility of the variety to pests and diseases. Whenever possible, varieties should possess resistance to commercially important pests and diseases.

d. Seed Treatments and Dressings:
Seed treatments can be an effective method of targeting disease control, reducing active ingredients applied to growing crops, and as a strategy for crop protection where foliar sprays are ineffective. Where an option exists to control a pest or disease with the use of a seed treatment or foliar spray, seed treatment should be the preferred option, however their use must be justified.

e. Nursery Stock:
Nursery stock must only be purchased from dealers accompanied by recognised plant health quality certification such as Plant Passports which exist under the EU Plant Health Directive or similar for countries outside the European Union. Quality or certified production guarantees must be delivered with the invoice and kept in the crop diary. Plant health quality control systems must be operational for private or in-house nursery propagation.

f. Genetically Modified Organisms (GMO):
Suppliers must inform all potential customers of any developments relating to the use or production of products derived from genetic modification. Planting of any GMO must comply with all existing regulations in the country of production and regulations in the country of the final consumer where product is destined for export. The use of GMO cultivars must be agreed with individual customers prior to planting.

4. SITE HISTORY AND SITE MANAGEMENT

a. Site History:
A recording system must be established for each field, orchard or greenhouse to provide a permanent record of the crops and agronomic activities undertaken in those locations.
It is important that prior to the use of sites without a recorded history, appropriate soil analysis based on a risk assessment is carried out. The results of such analyses should be recorded and may be used to justify that the site in question is suitable for horticultural production.

**b. Rotations:**
Growers must recognise the value of crop rotations and seek to employ these whenever possible to maintain soil condition and reduce reliance on agrochemicals to maximise plant health. Where rotations are not employed, growers must be able to provide adequate justification.

### 5. SOIL AND SUBSTRATE MANAGEMENT

**a. Soil Mapping:**
Soil maps should be prepared for the farm, which can then be used to plan rotations and planting and growing programmes.

**b. Cultivations:**
Mechanical cultivation can be used where proven to improve and maintain a good soil structure, and to avoid soil compaction.

**c. Soil Erosion:**
Field cultivation techniques that minimise soil erosion must always be adopted.

**d. Soil Fumigation:**
Chemical fumigation of soils must be avoided wherever possible. Alternatives such as field rotation, planting of break crops, use of disease resistant cultivars, thermal or solar sterilisation, conversion to soil-free cultivation, and similar techniques must be explored before resorting to use of chemical fumigants. The future use of methyl bromide must be in accordance with the Montreal Protocols, or the amendments and commitments made by individual countries under the Protocol. Growers must be able to demonstrate commitment to elimination of usage of methyl bromide in agreement with their customers.

**e. Substrates**
(Content will be agreed on in 1999 version)

### 6. FERTILISER USAGE

**a. Nutrient Requirement:**
Fertilisation using either mineral or organic fertilisers must meet the needs of the crops as well as maintaining soil fertility. A cropping or soil care plan should be developed to ensure that nutrient loss is minimised. The application of fertilisers should be based on a calculation of the nutrient requirements of the crop and on routine appropriate analysis of nutrient levels in soil, crop or nutrient solution.

**b. Advice on Quantity and Type of Fertiliser:**
Recommendations for application of fertilisers should be given by competent, qualified advisers holding appropriate recognised national certification. Where such advisers are unavailable, adequate training in fertiliser usage and application should be undertaken. Growers or their advisers must be able to demonstrate competence and knowledge.

**c. Records of Application:**
All applications of soil and foliar fertilisers must be recorded in a crop diary or equivalent. Records must include: location, date of application, type and quantity of fertiliser applied, the method of application, and operator.

**d. Timing and Frequency of Application:**
The quantity and timing of fertilisers for maximum benefit and minimal loss should be carefully considered. Any application in excess of national or international limits or that may result in excessive nitrate enrichment of ground water must be avoided. Quantities of nitrogen to be applied should be calculated from the nitrogen management plan.
e. Nitrate and Phosphate Levels in Ground Water:
It is the responsibility of growers or grower organisations to ensure that usage of fertilisers does not result in excessive nitrate or phosphate enrichment of groundwater in excess of national or international limits. The effect of mineralisation from use of organic fertiliser, and from organic matter in the soil, and from the potential of surface waters to carry surplus nutrients should be taken into account to minimise nitrate loss into groundwater. Growers should be especially aware of areas that are particularly sensitive to nitrate leaching (such as 'Nitrate sensitive areas'), with full use being made of buffer zones to reduce the risk of groundwater enrichment.

f. Application Machinery:
Fertiliser application machinery must be suitable for use on the land in question and be kept in good condition, with annual servicing and calibration to ensure accurate delivery of the required quantity of fertiliser.

g. Fertiliser Storage:
Fertilisers must be stored under cover in a clean, dry location where there is no risk of contamination of water sources. Fertilisers should not be stored with pesticides. If that is not possible, they must be clearly separated and labelled accordingly.

h. Organic Manure:
Organic Manure or compost can help improve soil fertility by increasing organic matter content to improve nutrient and water retention and reduce erosion. To avoid pollution by heavy metals or by nitrate leaching, analysis of levels of nutrient, heavy metals and other potential pollutants in manure should be completed before application. Proper account must also be taken of the nutrient contribution of manures. The use of raw untreated human sewage sludge for salad, vegetable and fruit crops is prohibited. Any use of treated human sewage sludge on land destined for agricultural production must be supported by data and/or recognised codes of practice which demonstrate that any carry-over of pathogenic organisms and other components which may have an adverse effect on human health are controlled to maintain risk at the lowest possible level.

7. IRRIGATION

a. Predicting Irrigation Requirement:
To avoid excessive or insufficient water usage, scientifically recognised methods of systematically predicting the crop requirement for water should be utilised, where possible adjusting local irrigation based on predicted rainfall and evaporation. Incorrect usage of water can have a detrimental effect on product quality. Daily rainfall records for outdoor production may be used to assist in planning irrigation requirement. Growers are recommended to obtain access to regular meteorological forecasts to aid irrigation planning.

b. Irrigation Method:
The most efficient and commercially practical water delivery system should always be used to ensure best utilisation of water resources. Flood irrigation systems are discouraged due to excessive wastage of water. Drip irrigation is preferred, while spray irrigation should only be adopted following planting or transplantation. Consideration should be given to a water management plan to optimise water usage and reduce waste, e.g.: irrigation at night, maintenance to reduce leakage, winter storage, collection of rainwater from glasshouses, etc. Water reservoirs should be kept covered to ensure they cannot become contaminated with bird faeces. All growers should maintain records of irrigation water usage.

c. Quality of Irrigation Water:
Based upon risk assessments, sources of water for irrigation should be analysed at least once a year by a suitable laboratory for microbial, chemical and mineral pollutants. Results of analysis should be compared to accepted standards and adverse results acted upon. Sewage water must never be used for irrigation.

d. Supply of Irrigation Water:
To protect the environment, water should not be abstracted from unsustainable sources. Advice on abstraction should be sought from water authorities or a relevant consultant.
8. CROP PROTECTION

a. Basic Elements of Crop Protection:
Protection of crops against pest, diseases and weeds must be achieved with the minimum pesticide input and adverse impact and the appropriate employment of non-chemical methods (biological and cultural/mechanical). Basic elements of crop protection are:

Prevention: indirect measures to reduce pest, disease or weed infestation,
- choice of crop/variety appropriate for the location
- use of crop rotations
- use of disease and pest resistant varieties
- mechanical and physical methods of crop husbandry
- good fertiliser and irrigation practices.

Observation: methods to determine when action is required,
- routine crop inspection and pest monitoring
- use of diagnostic and forecasting systems (traps, tests)
- use of decision support systems (literature, radio, television)

Intervention: direct measures to reduce pests, diseases and weeds to economically acceptable levels,
- cultural and physical controls (e.g., mechanical weeding)
- biological controls (beneficial insects, mites, nematodes, Bt, viruses)
- chemical controls (insecticides, fungicides, herbicides).
- climatic controls (temperature, humidity, light etc.)

Integrated Pest Management Systems:
Integrated pest management (IPM) is a pest management system that utilises all suitable techniques and methods in as compatible a manner as possible and maintains the pest populations at levels below those causing economically unacceptable damage or loss.

Growers are encouraged to understand and adopt IPM systems to control and preserve their productivity and minimise the potential impact of pest control on the environment. Assistance with implementation of such systems can be obtained through training, or advice from grower organisations, research organisations, and qualified extension officers, consultants or chemical distributors.

b. Choice of Chemicals:
Crop protection products must be appropriate for the control required. The use of selective products which are specific to the target pest or disease and which have minimal effect on populations of beneficial organisms, aquatic life and are not detrimental to the ozone layer should be used wherever possible. An anti-resistance strategy should be used to avoid reliance on any one chemical.

Growers must only use chemicals that are officially registered for use on the crop being protected, and follow the label instructions to ensure successful application, avoid risks to operators, consumers and the environment. Chemicals that are banned in the European Union must not be used. In addition, Growers must be aware of restrictions on certain chemicals in individual countries. Growers should consult their customers to determine if any additional commercial restrictions exist.

A comprehensive list of all products that are used and approved for use on crops being grown must be kept, which should take account of any changes in pesticide legislation.

c. Advice on Quantity and Type of Pesticide:
Recommendations for application of pesticides must be given by competent, qualified advisers holding a recognised National certificate or similar. Where such advisers are unavailable, adequate training on pesticide usage and application should be undertaken. Growers must be able to demonstrate their competence and knowledge.

d. Records of Application:
All applications of pesticides must be recorded in a crop diary or equivalent. Records must include: location, date of application, reason for application, type and quantity of pesticide used, application machinery used, name of operator and pre-harvest interval.

e. Safety, Training and Instructions:
Workers who handle and apply pesticides must be properly trained and given clear, written instructions or symbols on location, chemical dosage and application technique required.

f. Protective Clothing:
Workers must be equipped with suitable protective clothing in accordance with label instructions and the risk to health and safety of the chemical to be applied. Growers must be able to demonstrate that they follow label instructions precisely.

g. Pre-harvest Interval:
Pre-Harvest intervals must be observed and under no circumstances should the recommended pre-harvest interval be ignored. The harvest interval is the time between application of the chemical and to the time of harvest, and does not include the transportation time to the customer.

For crops that are continuously harvested over an extended period of time, there must be a plan for crop protection that does not compromise pre-harvest intervals. Such a plan may involve the use of field markers which clearly identify crop ready for harvest from the rest of the crop.

h. Spray Equipment:
Spray equipment must be serviced and calibrated on an annual basis. Participation in an independent sprayer calibration certification scheme is encouraged.

When Before mixing chemicals, the correct handling and filling procedures stated on label instructions must be followed. The correct quantity of spray mix for the proposed crop treatment must be calculated, accurately prepared and recorded.

i. Disposal of Surplus Spray Mix:
Under normal circumstances surplus spray mix should not occur if sprayer calibration is correct, however if surplus should occur, or if there are tank washings, they should be handled by recycling units where available or sprayed onto designated fallow land, where legally allowed, and records kept for future reference, ensuring the overall dose does not exceed the maximum permitted dose.

j. Pesticide Residue Analysis:
Growers and suppliers must be able to demonstrate that evidence of residue testing by laboratories accredited by the competent national authority to GLP is available. The frequency of pesticide residue analysis should be based on risk assessment, however in many cases pre-harvest sampling and analysis is most effective. Residue test results should be traceable to the grower and location of production of the product.

k. Pesticide Storage:
Pesticides must be stored in accordance with local regulations, but must include the following minimum standards:

- Pesticides must be stored in a sound, secure, fire-resistant, well ventilated and lit location away from other materials.
- The pesticide store must be able to retain spillage or have an adequate soak-away to prevent contamination of water courses.
- There must be adequate facilities for measuring and mixing pesticides.
- There must be emergency facilities (eye wash, plenty of water) to deal with operator contamination and accidental spillage.
- Keys and access to the store must be limited to staff with adequate training in handling of pesticides.
- An accident procedure and list of contact telephone numbers must be available in the store.
- An inventory and stock control documentation must be kept in the farm office.
- All pesticides must be stored in their original package.
- Only chemicals approved for use on the crops produced in the rotation must be stored on the farm.
- Powders must be stored on shelves above liquids.
- All shelving should be of non-absorbent material.
- Danger warning signs must be placed on access doors.

I. Empty Pesticide Containers:
Empty pesticide containers must not be re-used and disposal must be in a manner that avoids exposure to people, and contamination of the environment.
- All local regulations regarding disposal or destruction of containers must be observed.
- Empty containers must be rinsed three times with water, and the rinsate returned to the spray tank.
- When clean, containers must be crushed or pierced to prevent re-use, or adequately labeled according to the rules of a collection system.
- Empty containers must be kept secure until disposal is possible.
- Official collection and disposal systems must be used if available.
- If burning is the only option, ensure that the temperatures reached are higher than a bonfire by using appropriate temperature raising techniques.

m. Obsolete Pesticides:
Obsolete pesticides must only be disposed of through a certified or approved chemical waste contractor or supplying company, however equipment achieving the same result may be used.

9. HARVESTING

a. Hygiene:
GAP requires that harvest workers must have access to toilet and washing facilities in the vicinity of their work.

Workers must receive basic training in hygiene before handling fresh produce. Workers must also be made aware of the requirement to notify management of any transferable disease which may render them unfit to work in the vicinity of product destined for human consumption.

b. Packaging:
Packaging must be stored to avoid contamination by pests. Where products are field packed, packaging must be removed from the field overnight where a risk of contamination exists. Reusable plastic crates must be re-cleaned where necessary to ensure they are free from foreign material which may be detrimental to the product and/or consumers health.

10. POST-HARVEST TREATMENTS

a. Post-harvest Chemicals:

Use of post-harvest treatments should be minimised. If there is no alternative to ensure maintenance of good quality, they must only be used in accordance with product label. All applications of post-harvest treatments must be recorded in a crop diary or equivalent and include: location, date of application, reason for application, type and quantity of treatment used, application machinery used, and name of operator.

b. Post-harvest washing:
The source of water used for product washing must be to national drinking water standards, and must be filtered if recycled.

11. WASTE AND POLLUTION MANAGEMENT, RECYCLING AND RE-USE

a. Identification of Waste and Pollutants:
All the possible waste products should be identified in all areas of the farm business, e.g. paper, cardboard, plastic, crop debris, oil, rock wool and other substrates. All possible sources of pollution should be identified e.g.: chemicals, oil, fuel, noise, light, debris, packhouse effluent, etc.

b. Waste and Pollution Action Plan:
Having identified waste and pollutants, a plan should be developed and implemented, to reduce wastage and, whenever possible, avoid use of land-fill or burning by recycling the waste. Organic crop debris can be composted on the farm and reused for soil conditioning where there is no risk of disease carry-over.

12. WORKER HEALTH, SAFETY AND WELFARE

a. Training:
Formal training must be given to all people handling and using agrochemicals, and all people operating dangerous or complex equipment. Records of training for each employee should be kept in the interests of operator safety. Staff trained in First Aid should be present in both field and packhouse. Accident and emergency procedures must exist and instructions must be clearly understood by all workers.

b. Facilities and Equipment:
First Aid boxes must be present at all permanent sites and in the vicinity of field work. Hazards should be clearly identified by warning signs where appropriate.

c. Pesticide Handling:
In the interests of worker health, those staff who undertake pesticide applications on the farm must receive regular health checks in line with guidelines laid down in local Codes of Practice.

d. Hygiene:
Staff should receive basic training in hygiene requirements for handling of fresh produce. To avoid establishing a breeding ground for pests and disease, premises should be clear of litter and waste, and have adequate provision for waste disposal. All permanent packing and storage sites must have adequate pest (including rodent) control measures, particularly in areas for food handling, storage of packaging, and storage of pesticides and fertilisers.

e. Welfare:
All employment conditions must comply with local and national regulations concerning wages, age, hours, working conditions, job security, unions, pensions and all other legal and health requirements. Growers and packers must consult with their customers to ensure compliance with specific company policies.

13. ENVIRONMENTAL ISSUES

a. Impact of Farming on the Environment:
In the light of consumer concern, Growers should understand and assess the impact that their farming activity has on the environment, and consider how they can enhance the environment for the benefit of the local community and flora and fauna.

b. Wildlife and Conservation Policy:
Each grower should have a policy for management of wildlife and conservation of the environment on their own property that is compatible with sustainable commercial agricultural production and minimised environmental impact. A key aim must be the enhancement of environmental biodiversity on the farm through a conservation management plan.

Key elements of this plan will be to:
- Conduct a baseline audit to understand existing animal and plant diversity on the farm. Conservation organisations can help conduct surveys to measure biodiversity and identify areas of concern.
- Take action to avoid damage and deterioration of habitats.
- Create an action plan to enhance habitats and increase biodiversity on the farm.
c. Unproductive Sites:
Consideration should be given to the conversion of unproductive sites such as low lying wet areas, woodlands, headland strip or areas of impoverished soil, to conservation areas for the encouragement of natural flora and fauna wherever possible.