discussion paper no. 4

# Microcomputer Usage in the Horticultural Office

## An analysis of software requirements and availability in New Zealand 86

Department of Horticulture
Landscape
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## An analysis of software requirements and availability in New Zealand

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## FOREWORD

This discussion paper is based on an honours dissertation prepared by Philip Williams as part of a B.Hort.Sc. Honours degree and supervised and edited by G.F. Thiele.

The initial intention was to survey computer usage in horticulture on a broad scale encompassing research, academic, advisory and practical uses. Subsequently the survey was confined mainly to office usage of microcomputers associated with information systems and horticultural planning. This has largely eliminated consideration of software for mathematical techniques such as linear programming and simulation. The computerised control of technical aspects such as glasshouse environment and irrigation has been ignored as well.

It is recognised that computer hardware technology and software development is changing rapidly and that the information supplied in this publication will become outdated very quickly. Nevertheless, the impact of computers on horticultural property management is likely to be significant in the next decade and some documentation of the availability of software and its compatibility with hardware is considered essential at this stage. Although some of the major firms and organisations concerned with the implementation of microcomputers in farming have developed software specific to horticulture there remains the need for continued knowledge and awareness of the requirements of the horticultural industry. It is hoped that the information contained in this publication will provide the basis for orderly development and coordination of computer usage by horticulturists and those servicing the industry.

Although the survey net was spread widely to accurately document the present situation in horticulture, no responsibility will be taken for omissions or inaccuracies in the publication.

Richard N. Rowe
Professor and Head
Department of Horticulture Landscape and Parks

December, 1985.

CONTENTS

## SUMMARY

This discussion paper describes horticultural software available to growers and explores the use of microcomputers in the horticultural office and within the Ministry of Agriculture and Fisheries' Advisory Services Division.

A survey was conducted of thirty-eight firms and individuals and a range of other surveys and literature reviewed and discussed.

Videotex is described in relation to commercial services, the Ministry of Agriculture and Fisheries and developments overseas.

The microcomputer has been rapidly incorporated into many New Zealand businesses, but adoption by horticulturists has been slow due to:

* a lack of how-to knowledge
* an unfavourable perception of the attributes of microcomputers
* a shortage of grower-orientated software
* the low profile of New Zealand software producers
* a lack of coordinated development.

Many growers could benefit from using a computer. There is an increasing awareness of the potential benefits and this will lead to a more rapid rate of adoption. Benefits of computers involve all aspects of financial management, especially budgets and wage processing, and physical recording.

Several companies are offering comprehensive horticultural systems available throughout New Zealand.

## 1.0 INTRODUCTION

In the 1970s the development of a third generation of computers brought the potential of computer ownership to the individual grower. In 1975, with the utilisation of the microprocessor as part of a microcomputer system, the first small computer entered the marketplace in the United States.

Microcomputers first appeared in New Zealand around 1979. Computer technology has proven to be vastly productive, revolutionising many industries and jobs.

Microcomputers are becoming significant in the horticultural environment and have the potential to become widely adopted. Their significance is indicated by the amount of time growers are spending using them. Nuthall, (Kellogg Farm Management Unit) surveyed computer users registered with the Unit. Advisors and consultants averaged nearly 20 hours and horticulturists 6.7 hours per week of computer usage (Anon., 1985a), which represents a major management cost to the farm system.

This discussion paper:

1. Reviews the use of computers in decision making and the provision of information
2. Describes the software development within the Ministry of Agriculture and Fisheries' (MAF) Advisory Services Division
3. Describes the major benefits of computer use and the criteria for selection of a system
4. Summarises the software available for horticulture
5. Discusses the application of microcomputers by growers.

Hales (1966) submits it is not necessarily correct to classify horticulture and agriculture together both economically and sociologically. In this paper agricultural sources have been used where applicable to horticulture.

The authors reason that computers will be adopted more rapidly by the horticultural than the agricultural sector:

* horticultural development is generally centred around the cities where growers are exposed to the urban business environment and people with computerised systems

* horticulture's highly capital intensive production systems necessitate a high level of property and business management
* a number of growers and developers have come from a business background and operate an office rather than a 'kitchen table' (Ryde and Nuthall, 1984) office-work environment
* computerisation of grading equipment, environmental controllers and irrigation systems is increasing.

The authors estimate that less than 2.5 percent of horticulturists in New Zealand use a computer as an aid to decision making at present.

# 2.0 COMPUTERS AND DECISION MAKING

## 2.1 CONTROL, PLANNING AND MANAGEMENT INFORMATION SYSTEMS

A computer cannot make decisions, solve problems or change the overall environment within which a property operates. It can provide information and allow a grower to work out the cumulative financial implications of a decision option. Successful management depends on recognising problems and on making and implementing decisions. Information seeking and decision making can occupy a significant part of a manager's day.

There are two types of decision making:

* operational decisions for control
* strategic decisions for planning.

COMPUTERS AND CONTROL

Control is the measuring of performance against predetermined goals and action taken to correct deviations from these goals. Computerised control systems allow the grower to make a comprehensive analysis and identify factors that contribute to success or failure. Control incorporates the efficient recording of financial and physical data.

With a well-designed control system, microcomputers should allow improved production techniques to be practised. A control system should:

* allow access to previous years physical and financial performance
* permit single data entry
* reference performance against targets
* indicate which variables are responsible for divergence between achievement and target.

Increased profitability is usually more easily achieved by improvement of existing performance rather than altering enterprise mixes. Often the margins can be increased substantially through tightening up supervision and control.

Anderson and Hardaker (1983) question the usefulness of computerised control systems in horticulture where the length of production cycles

and external factors like weather and prices are outside managerial control. They argue that a good manager using highly intuitive information may be nearly as effective as a manager using a sophisticated recording system.

## COMPUTERS AND PLANNING

Computerised aids to farm management have their origins in planning. Planning is important to set goals and so avoid the situation in which management is little more than a reaction to a succession of unforeseen crises.

A summary of planning techniques has been documented by Davis (1979). Sophisticated planning aids for maximising profit such as linear programming have had limited success for several reasons:

* a lot of data is needed
* operation of the programs has been remote from the farm
* results have been too simplistic, yet at times overwhelming.

Simulation models however, appear to be well-suited to the real-world representation of dynamic and stochastic systems. Systems simulation is the use of a model to mimic or represent the interactions of operations or components of a property. The characteristics of simulation models are:

* a free-form structure
* stochastic and dynamic elements
* models are 'run' rather than 'solved'.

Lewis and Thiele (1981) state that the use of skeleton models would appear to be the only way for computerised management information systems to be used on a significant scale in horticulture.

The authors believe it is important that horticultural planning models can be carried out on the property. A system where an on-farm terminal is linked to a central computer would be beneficial for the adoption of planning techiques which require large computer resources or external sources of data.

MANAGEMENT INFORMATION SYSTEMS

Cavit (1982), a chartered accountant in Kumeu, related personal experience of horticultural clients facing financial difficulties through decisions based on inadequate or false information. Conversely, it is ridiculous to keep information just because there is the technology available to record it.

Information must be:

* directly applicable
* cost effective
* unique (not available elsewhere)
* presented in an easily assimilated form (eg. charts, graphs and tables).

As well as information for business control and planning, statutory requirements dictate the need for government taxation, farming and employment information.

A management information system (MIS) should emphasise speed, time efficiency, accuracy and be sufficiently relevant and comprehensive. A comprehensive computerised MIS can facilitate a systematic approach to horticultural property control and planning.

Lewis and Thiele (1981), and Anderson and Hardaker (1983) express concern that a user orientated approach to MIS's is lacking. Emphasis must be placed on the goals, attitudes and decision making behaviour of average growers.

## 2.2 COMPUTERISED INFORMATION SERVICES

Information has become the basis of a rapidly developing industry in which databases play a key role in storage and distribution.

A lot of confusion exists about television or computer viewable information services.

TELETEXT

'Teletext' is a computer based television broadcast, offering a limited range of general and farming information. The only cost of receiving 'Teletext' is in the acquisition of a 'Teletext' capable television set. 'Teletext' is limited to several hundred pages, the spare television transmission capacity.

VIDEOTEX

Videotex is a two-way communication over a telephone line between a user via a terminal and the central computer. Videotex is the internationally adopted term for the system also known as 'Viewdata'.

Videotex output may be recorded by a computer and printed on a printer. A problem in rural areas is that videotex systems cannot be used on multi-party telephone lines. The Post Office is aware of this and is endeavouring to update rural telephone communications.

The potential of videotex is in the supply of information not otherwise readily available from newspapers or by telephone (for example daily produce market prices). Only when it supplies information not otherwise available will videotex make an impact. Other uses include:

* electronic messaging to other selected users at little cost
* ordering of goods, bookings, banking
* use of central computer software
* use of the closed-user-group (CUG) facility to provide confidential specialised information within an organisation or among clients.

ADITEL

'Aditel', a New Zealand designed public videotex database, operated by BPI Systems Ltd, Box 10-099, Wellington, has been specifically set up to cater for the needs of farmers and investors. Launched in mid-1984, 'Aditel' holds 7 000 pages specialising in agricultural and commercial information.

Presented below is an outline of the costs of receiving 'Aditel':

EQUIPMENT COSTS

There are three ways to receive videotex:

* purpose built videotex terminal. $2 200 or $80 per month rental
* adaptor. $900 or $40 per month rental
* with an addition to some brands of microcomputer including IBM PC and Apple. $800.

ADITEL CHARGES

* Aditel registration. $50
* Aditel subscription. $10 per month
* time-based charge. Subscribers receive 2 hours free use per month. For use in excess of 2 hours, a charge of 17 cents per minute is levied.

POST OFFICE CHARGES

* jackpoint installation $40 (Post Office)
* users are charged 8 cents per minute by the Post Office (anywhere within New Zealand) in addition to 'Aditel' charges.

There is no practical limit on the capacity of videotex. 'Prestel' in Britain offers over 200 000 pages of information.

In Australia, rural information services are marketed by Elders Pastoral group, Grassroots Australia and Agridata Australia Pty Ltd. The 'Agridata' system is tied to microcomputers, with the screen showing text only, while the 'Elders' and 'Grassroots' videotex systems feature full colour graphics and work on either television or microcomputers. Through the use of graphics the two latter groups will be able to carry out a range of advertising. The two videotex systems are claimed to be cheaper because the advertiser pays much of the cost (Anon., 1984a).

## 2.3 MINISTRY OF AGRICULTURE AND FISHERIES COMPUTING FUNCTIONS

Ministry of Agriculture and Fisheries (MAF) computing functions operate at three levels:

1. Computer Services Group provides computing services in two broad areas:
   * the management of the MAF computer network of 'supermini' and mainframe computers (including 'MAFNET')

* consultative advice on hardware and software.

2. Advisory Services Division's (ASD) National Info-systems Centre (formerly Electronic Data Processing) is currently based in Christchurch. The role of this unit is to develop application programs and database services relating to ASD information.

3. Independent development of 'Supercalc' spreadsheet templates by advisory officers.

The most significant developments have been occurring in National Info-systems. The importance of computing's role in ASD and in farming has been realised by a doubling of their budget in 1985. Staff will be expanded from five to fourteen, and fifteen Apricot microcomputers have supplemented the 38 Northstar Horizons commissioned during the 1979-1983 period. The 15 Apricots have 512K RAM, two 720K floppy disks and a 10MB hard disk.

Until now, the software developed by National Info-systems has been used by ASD only. There has been a marketing contract with the Kellogg Farm Management Unit at Lincoln College to allow for sales to non-MAF clients. This contract is now being cancelled as MAF intends to market its own information and software.

National Info-system's software covers analytical decision making rather than farm recording.

Access to software and information on a user-pays basis may be provided through:

* the linkup of MAF mainframes with videotex similar to some systems in the United States (Legacy et al., 1984). This will solve microcomputer incompatibility problems and eliminate the illegal copying of software. Users may get a preferential rate if data is retained on the mainframe for regional and national decision making purposes.
* an alternative or addition to the videotex system, would be to contract sales through a franchiser.

Users of the proposed videotex option could include stock and station agents, government bodies such as the Rural Banking and Finance Corporation and Department of Maori Affairs, farmers/growers and firms servicing the agricultural/horticultural sector.

A possible development is the distribution of 'Aglinks' on videotex. This would be beneficial for those 'Aglinks' where timeliness is a consideration.

SOFTWARE

'Supercalc' spreadsheet templates developed by advisory officers include:

| | |
|---|---|
| AUTRASP | costing for autumn raspberries |
| RASPHAND | costing for raspberries - hand harvested |
| RASPLITT | costing for raspberries - machine harvested |
| RASPINP | costing for raspberry inputs |
| STRAWAK | strawberry costing - Auckland |
| STRAWCH1 | strawberry costing - Christchurch Year 1 |
| STRAWCH2 | strawberry costing - Christchurch Year 2 |
| STRAWCH3 | strawberry costing - Christchurch Year 3 |
| ASPESTAB | asparagus establishment costs |

Prior to the formation of the specialist ASD computing unit, a number of programs were developed by horticultural advisory officers. These include:

| | |
|---|---|
| APPLES | apple yield forecast |
| HORTIC | 10 year cash flow for apples, kiwifruit and grapes |
| GMARGIN | vegetable gross margin |
| GBUDGET | vegetable budget |

These are being replaced by a number of programs developed by the National Info-systems programmers with the advice of horticultural advisory officers:

PRICES a program which collects information from the user on crop prices. The user has the option to:

* store the data
* display the data in graph form
* obtain a statistical report on the data
* interpolate the values of missing data.

INVEST a feasibility and profitability investment analysis program. The user enters financial data relevant to the investment and

the program produces a detailed financial analysis of the proposition at user-defined inflation rates and incorporating the current taxation laws.

CASH cash flow analysis program.

CROPCOST this program allows the user to construct a detailed physical model of one hectare of the selected crop. This is 'costed' from a file containing the current costs, producing a financial model of any number of hectares. The data file can link directly into 'INVEST' for financial analysis. Future development will allow the user to amalgamate a range of crop models at different time periods to produce a budget for multi-crop situations. Separate models are to be developed for:

* orchards
* field crops
* protected cropping
* berryfruit.

Other MAF departments are involved in microcomputer software use and development:

* a linear program is available for resource allocation applications.
* a Research Division national soil model and an ASD district-specific model called 'FERTLIZ' is used to analyse soil test data. 'FERTLIZ' selects the appropriate least cost fertiliser to convert soil test results into specific fertiliser recommendations.

## 2.4 CRITERIA FOR SELECTION

Brooker, of Fieldcraft Systems Ltd., who developed the software for Yates Farmfax Ltd., believes any successful farming package should fulfil these criteria (McKinnon, 1984):

* must be designed by farmers and written by people with an agricultural background
* must be written specifically for New Zealand farming conditions
* must be value for money
* must be simple to use yet expandable and challenging
* must be totally supported
* must be continually updated
* there should be some choice of hardware.

Gillespie, a former farm consultant and now a Massey University senior lecturer believes growers must know what they want from computers and have a strong desire to be management orientated. He doubts that this is the case at present.

Lissaman, managing director of Primesoft Farm Plan (N.Z.) Ltd., warns that purely financial recording is inherently unsound, as it does not take into account physical factors. Whether a low export packout is due to size, shape, disease or windrub is important management information.

Saunders, a Hamilton orchardist records:

> "We would now consider the most important part of any package to be the back-up and training services available. These have been totally lacking with 'Multiplan' (a spreadsheet) and the trial and error learning system has proved very costly in many ways. Whilst the back-up for 'FRS' (Kellogg 'Farm Recording System') has been considerable, it would be better still if an agent locally were able to help and advise."

There are strong recommendations from experienced computer users to approach the selection of a computer system in this way:

* work out the requirements in terms of the property's needs: unless a system exactly meets the needs of the grower, it will degrade the functionality of that system
* find the software that can perform these tasks
* then consider the hardware that can handle it.

Nuthall advocates the purchase of a machine which allows considerable scope for expansion and which is capable of providing detailed and comprehensive management data (McKinnon, 1984).

The authors add these criteria. The system must:

* permit single data entry
* be developed by a company with a commitment to the development of software for horticultural applications other than financial management; such as coolstore management, integration of programs with environmental monitoring devices and plant labelling.

## 3.0 NEW ZEALAND SOFTWARE SURVEY

New Zealand firms have been surveyed for information on software applicable to the horticultural office. A summary of the material supplied in response to the questionnaire follows. One firm approached did not supply material and there could be others who were not surveyed.

To obtain information the authors surveyed three subject groups:

* growers
* horticultural advisors/consultants
* horticultural software producers

Individuals to whom the authors had convenient access were surveyed by a non-directive interview. Interviewing was a suitable medium to allow the exploration of different issues, the observation of the computer in the workplace and to receive impressionistic or emotional clues from the subject and context. Other individuals were surveyed by questionnaire. Replies were thorough which encouraged the authors to believe that the respondents were excited about this area of technology.

Horticultural software is rapidly developing. Over the six months the survey of software has been compiled, some programs will have been added by firms.

The authors have found some terminology unclear when reviewing software descriptions. These descriptions have been presented as described by the individual firms. This discussion paper does not critically assess the software available but summarises the information obtained relating to the companies.

It was necessary to read a large amount of literature to gain an understanding of microcomputers and the New Zealand software industry.

One of the authors has compiled a paper (Williams, 1985) discussing sociological questions and implications of the adoption of microcomputer technology from the results of these surveys and other literature.

General business programs used by some horticulturists have not been described. Some of these companies may offer horticultural applications such as plant labelling. All programs are menu-driven.

## I. AGRICOLA

Agent: Businessworld Computers Limited (in 8 main centres)
Box 1013 CHRISTCHURCH

### HARDWARE COMPATIBILITY

IBM PC

### COST OF SOFTWARE

| | PRICE ($) |
|---|---|
| Cashbook Module | 450 |
| Forecast Module | 450 |
| Tables Module | 450 |

### SOFTWARE DESCRIPTION

Designed for agriculture. Agricola runs in conjunction with the 'Lotus 1-2-3' spreadsheet system. The spreadsheet can be used independently. Each Agricola module can be used independently or may be integrated with others. Menu-driven.

1. CASHBOOK MODULE

Designed to accommodate a full year's transactions. Extensive summary and inquiry facilities are provided.

2. FORECAST MODULE

A 12-month cash flow forecast which can be used independently of, or linked directly to the cashbook. Supporting schedules include production and input estimates, complete with stock reconciliations and also an estimate of taxation liability for the year.

3. TABLES MODULE

A quick reference program combining a broad range of financial tables and investment ratios.

## FUTURE DEVELOPMENT

Other Agricola series modules are under development.

## II. AGRIPLAN FARM COMPUTER SOFTWARE

BOX 239 RANGIORA

There are two systems available:

## IIA. AGRIPLAN

### HARDWARE COMPATIBILITY (Agriplan)

Apple IIe, Apple Macintosh, Apple IIc

### COST OF SOFTWARE (Agriplan)

| | PRICE ($) |
|---|---|
| Physical and Financial Forecasts | 300 |
| Crop Cash Flow | 300 |
| Multiplan spreadsheet | 500 |
| Appleworks spreadsheet | 620 |

### SOFTWARE DESCRIPTION (Agriplan)

Agriplan templates run in conjunction with the 'Multiplan' and 'Appleworks' spreadsheet systems. Operators can alter the templates or prepare their own template layouts. Two templates have been prepared specifically for horticulture.

1. PHYSICAL AND FINANCIAL FORECASTS

These programs are prepared specifically for stonefruit, pipfruit and kiwifruit. Interactive worksheets prepare physical and financial estimates over a 13 to 15 year development period. Various parameters can be altered including rate of development, yield, price, and costs, to establish the likely cash flow profile over the planning period.

2. CROP CASH FLOW

This program provides a detailed annual and monthly analysis of income and expenditure. Key figures are extracted from the main budget

framework and listed in a summary section to give an indication as to the production and financial efficiency. The budget can be updated with actual figures in place of the budget estimates.

## IIB. FARMPLAN INTERNATIONAL

### HARDWARE COMPATIBILITY (Farmplan)

IBM PC, Apple, most hardware systems

### COST OF SOFTWARE

| | PRICE($) |
|---|---|
| Operating System and Language | 600 |
| Cashbook | 795 |
| Crop Management Program | P.O.A. (price on application) |

### SOFTWARE DESCRIPTION (Farmplan)

1. CASHBOOK

Presents financial management reports with fully integrated budgeting and cash flow facilities, from a simple data entry system. The cashbook program can handle up to 160 column headings (ledgers) and up to 1200 transactions per year. Includes:

BUSINESS SUMMARY — A facility to produce an enterprise margin report, showing actual against budget.

ALLOCATION SUMMARY — Individual enterprise reports can be printed.

AUDIT TRAIL — Each month-end a complete list of all transactions, during that month, is available. They are all detailed under their own specific heading. Any figures that do not reconcile are asterisked.

CASH FLOW — This program allows the user to build up an integrated budget and cash flow forecast. Reports can be obtained monthly, quarterly or annually.

PROFIT ESTIMATOR This facility allows the user to calculate expected profit.

2. CROP MANAGEMENT PROGRAM

Designed to provide block-by-block, crop-by-crop management. It has the facility to create crop budgets, compare actual against budgeted, form commodity requirement lists and to keep accurate stock control of applications, deliveries, purchases and usages. There is also a full analysis facility. All usages are entered on a block-by-block basis. Printed or screen reports can be produced on demand :

* gross margin inspection (by enterprise, block, crop, or variety)
* cropping summary
* monthly enterprise reports
* enterprise analysis
* action reminder lists
* commodity listings and balance sheet
* commodity movement list
* historical reports

Capacity : 120 field reports, 10 enterprises, 50 different crops, 100 varieties, 10 soil types, 43 application programs, 230 commodities. Up to 300 fields and 30 enterprises can be handled with an alternative hardware configuration.

GENERAL

'Farmplan' originated in the United Kingdom and is marketed in the United States, Canada, Australia and South Africa. The program is referenced to the manual throughout.

SUPPORT SERVICES

Training through manuals, personal contact and seminars. Backup through personal visits, telephone calls and local dealers. Follow-up assistance until satisfied.

## III. AGRISOFT LTD

BOX 4244 NEW PLYMOUTH

### HARDWARE COMPATIBILITY

IBM PC, IBM compatibles, Wang, Sanyo, Kaypro, Epson QX-10, CP/M

### COST OF SOFTWARE

| | PRICE($) |
|---|---|
| Horticultural Budget, Cashbook, Personal Balance Sheet + Trend Analysis | 1495 |
| Financial Management Package (budget program excluded) | 1495 |
| Expanded Financial Management Package (includes all the above) | 2495 |
| Complete Accounting System, Farming and Horticulture: | |
| without budget program | 2495 |
| with budget program | 3495 |

### SOFTWARE DESCRIPTION

Integrated.

1. ANNUAL BUDGET AND CASH FLOW

Shows profitability of proposed management plan and effect on working capital position. Gives expected taxable income. Inputs can be varied in any section so that alternative models can be compared on screen or as a printout. Can be expanded into a monthly cash flow. Data from this can be transferred into the cashbook in order to compare budget and actual figures. Includes full facility for gross margin analysis. No coding necessary.

2. HORTICULTURE CASHBOOK

Fully compatible with budget, enabling comparisons to be made with this year's budget and last year's actual. Entries are made under main

category headings according to a simple supplied code. There are 30 headings for entry of expenditure. Virtually no limit on the number of transactions, and transaction tracking. Cashbook balance is reconciled with bank statements. Provides a list of transactions to date with details under any requested category heading.

3. FINANCIAL MANAGEMENT PACKAGE

Comprises:

* cashbook with facilities for comparison with budget and last year's cashbook.
* trial balance.
* produce and production accounts.
* preliminary farm working account.
* listing of transactions as entered in the cashbook.

4. MODULAR-BASED ACCOUNTING PACKAGE (Farming and Horticulture)

Users require a knowledge of double entry accounting and taxation. Suitable for a practising accountant. Reports include those in the financial management package as well as:

* depreciation schedule and summary
* development adjustment account
* income adjustment account
* income appropriation account
* capital account
* balance sheet
* statement of taxation deferred income
* cash flow statement.

SUPPORT SERVICES

12-month software defect guarantee. Will adapt packages to individual requirements.

FUTURE DEVELOPMENT

Current developments include:

* an enterprise accounting option
* a payroll.

## IV. AWA NEW ZEALAND LIMITED

BOX 50-248 WELLINGTON

Marketed through New Zealand Fruitgrowers' Federation Ltd.

### HARDWARE COMPATIBILITY

IBM compatible PCs require:

10MB hard disk
384 K RAM
8087 co-processor recommended

### COST OF HARDWARE/SOFTWARE

Normally sold as a complete system. Price on application. Software available separately for $3 865.

Corona PC with detached keyboard and screen
384K RAM
320K floppy disk
8087 co-processor
10MB hard disk
MS-DOS operating system
wordprocessor, BASIC language and PC-TUTOR
Oki 83A line printer
AWA LYNXoffice software including documentation and training

### SOFTWARE DESCRIPTION

Integrated.

1. PAYROLL

After setting up the relevant information for each employee, the orchardist enters the hours worked each period. The program does all pay calculations including PAYE taxation and allowance payments, printing payslips and a banking record. Regularly worked hours, fixed allowances, and deductions such as union fees are only entered once. Employees can be divided into different worker types and grades with predefined wage rates. At the end of the financial year the computer

will print IR12Ds and IR68 (taxation) information. A comprehensive bonus system is included. Employee hours and production may be logged by job, block, and variety.

2. DEBTORS

A simplified debtors module allows easy entry of payments received from fruit sales and other income. A full debtors system will be made available as an optional extra.

3. CREDITORS

Invoices are entered and can be paid in the month of entry or held over and paid later. The computer keeps track of all payments so that there is no need to pay invoices as they arrive. Remittance slips can be printed to accompany cheques. Detailed information on all creditors can be kept and accessed at any time. Invoices can be logged to particular jobs, orchard plots, and general ledger accounts.

4. GENERAL LEDGER

This is linked to the debtors, creditors, and payroll systems. Wages, invoices, cheques and regular payments automatically go into their relevant ledger accounts each month. The ledger comes set up with typical orchard accounts which can be easily altered. The computer automatically keeps a cashbook which can be reconciled with bank statements at the end of the month. At the end of each month a profit and loss statement can be printed. A financial statement, including balance sheet accounts can be produced at the end of the year.

5. ORCHARD MANAGEMENT SYSTEM

The cost of particular jobs such as spraying and pruning can be accurately tracked along with the performance of orchard blocks. Productivity and profitability reports will help informed decision making on plantings and development schemes. The information is automatically gathered from the other modules.

6. LYNXoffice.

Comprises:

CALC A full-function on-screen calculator can be accessed within any system.

NOTE PAD An on-screen note pad can be accessed immediately from virtually anywhere in the system.

PLAYGROUND Gives the user full access to all the system's features without disturbing the real information.

## GENERAL

AWA 'LYNX' systems are a joint project with the New Zealand Fruitgrowers' Federation Ltd.

In addition to 'LYNXoffice' there is an electronic sizing and fruit handling range of products developed called 'LYNXsize'. The electronic fruit sizer can be integrated with the orchard management system to gather production information from the packing operation. This produces a breakdown of packout percentage by variety, type, quantity and weight.

## SUPPORT SERVICES

Initial training and additional help available from local Fruitgrowers' Federation offices.

24 hour AWA phone-line for free assistance and advice.

## FUTURE DEVELOPMENT

Further developments are planned.

## V. FARMFAX

YATES FARMFAX LTD. BOX 1147 TAURANGA

### HARDWARE COMPATIBILITY

Epson QX-10, Hewlett-Packard 150 PC, ICL 36, Sanyo 550

### COST OF SOFTWARE

| | PRICE ($) |
|---|---|
| Horticultural Package (Financial, General, and Horticultural Management systems) | 2250 |
| Market Gardening (as an add-on to the above) | 200 |
| Coolstore Management System | 3440 |
| Wages Package | P.O.A. |

### SOFTWARE DESCRIPTION

Integrated.

1. FARM ACCOUNTING AND FINANCIAL ANALYSIS

Designed to provide the grower with a set of integrated programs to :

* record all actual transactions
* prepare financial accounts
* prepare budget forecasts for cash flow management
* simulate changes in the financial structure and analyse the results
* compare budget cash flows with actual
* prepare reports to analyse the sensitivity of the financial status to changes in any part of the business or transactions
* any other required and relevant financial reports and comparisons.

CASHBOOK In the setup the cashbook is prepared and cash flow requirements are given to the system. Budget and actual figures, and variances for each item used in the accounts, can be shown.

CASH FLOW Monthly cash flow. This uses the cashbook entries to produce a budgeted cash flow for the year and actual cash flow up to the current month, then budgeted cash flow to the end of the

financial year.

ASSETS An assets and depreciation register for up to 60 items, including buildings, plant and equipment, and vehicles.

LOANS A program catering for up to ten lenders giving a summary of all loans and a table for each loan showing interest and principal due for each year of the loan.

UPDATES An actual data entry program to allow recording of transactions as they happen. It also provides :

* a register of unpaid accounts.
* an audit trail
* a facility to search the audit trail for any one piece or group of information.

2. HORTICULTURAL MANAGEMENT SYSTEM

A modelling and analysis system enabling the grower to model the production operation and then assess performance from the recordings of physical inputs and the resultant output:

* to record all actual events and maintain access to any detail regarding the business such as:
  - crop yields, prices, weights
  - all income and expenditure items for each crop or part/whole of the property
  - spray and fertiliser schedules.
* for making accurate profitability analyses between alternative forms of production systems, crops or varieties on the property
* for monitoring the performance of all aspects of the property
* to utilise the information available within the system, to model or simulate alternative management strategies or systems
* to provide information for the preparation of income and expenditure accounts.

Four analyses are available :

* block
* crop
* variety
* orchard (grade by grade).

AUTO UPDATE Enables automatic updating of detailed property analyses as changes are made.

PACKING AND INCOME Handles all block income and packaging detail on a block-by-block basis.

SEARCH FILES Enables the operator to search all actual transactions for any item of information held. It provides instant access to any information within the system, whether it concerns financial transactions or an item of information within any of the horticultural programs.

3. GENERAL DIRECTORY

DIARY A facility for recording and recalling miscellaneous items of information, by date or by folder.

BREAKEVEN ANALYSIS This program forms the basis of the sensitivity analysis. It includes price/yield variation tables, for calculating the breakeven points and sensitivity of income to yield and price variation. The breakeven analysis can also be used to test the level of an important variable.

CONVERSION TABLES

NOTE: The 'Farmfax Horticultural Package' which includes the three systems outlined above, has been updated to include:

* plant monitoring
* labour profiles
* stock inventory
* staff wages.

Details of these and the coolstore, wages and market gardening packages are available from Yates Farmfax Ltd.

## GENERAL

Yates Farmfax Ltd. is a joint venture company formed between Yates Corporation Ltd. and Fieldcraft Systems Ltd.

The company sells their system through horticulturists who have an

understanding of, and are interested, in computer technology. These agents demonstrate and install while after-sales support comes back through Yates Farmfax. This approach recognises that farmers understand the local environment and their fellow farmers better than anyone else.

Yates Farmfax also markets a range of commercial software products.

## SUPPORT SERVICES

Free installation.
Free introductory 3 day training course for users.
Toll-free 24 hour per day, 7 day per week phone-line.
Comprehensive manuals.
Software has a 24-month guarantee.
Maintenance contracts available at the expiration of the guarantee period.

## FUTURE DEVELOPMENT

Current 'FARMFAX' developments include:

* integration of 'FARMFAX' to environmental control electronics.
* a nursery management package: labelling, customer records, plant analysis/monitoring, stock control and location.

## VI. KELLOGG FARM MANAGEMENT UNIT

LINCOLN COLLEGE CANTERBURY

### HARDWARE COMPATIBILITY

CP/M and MS-DOS systems.

### COST OF SOFTWARE

| | PRICE ($) |
|---|---|
| Breakeven Prices | 100 |
| Cash Flow | 90 |
| Crop Gross Margin | 240 |
| Financial Budgeting System | P.O.A. |
| Financial Recording System | 660 |
| Investment Analysis | 50 |
| Metric-Imperial Equivalents | 50 |
| Production Recording System | 380 |
| Table Mortgage Calculations | 50 |

NOTE : The price includes a user guide but not program installation or training.

### SOFTWARE DESCRIPTION

Where appropriate programs are designed to operate as integrated packages.

1. BREAKEVEN PRICES

Calculates equivalent future price given today's price, inflation rate, interest rate and other parameters.

2. CASH FLOW

Monthly actual and budget comparisons as well as monthly and cumulative balances.

3. CROP GROSS MARGIN

A detailed forecast enterprise budget for any crop based on the user's practices, yields and prices. Calculates effect of parameter variations and enables comparisons of the profitability of alternative crops.

4. FINANCIAL BUDGETING SYSTEM

A package for forecasting the financial outcome of a production plan based on all cash items including operating, development, capital and personal categories. The program can be used for comparing alternatives and producing a blueprint on which to base operational plans.

Any item can be individually accessed or sequences used if desired. Change, add, delete facilities enable constant updating for each item as changes occur. As changes are made, old values are always displayed to act as a reference.

Includes a cash flow facility for creating a monthly cash flow from a specified budget file.

Reports include:

* budget summary
* production summary
* cash flow
* detailed reports.

The cash flow can be passed to the financial recording system to form the basis of monthly actual-forecast income and expenditure comparisons and produce estimates of taxable profit. Many linked annual forecast budgets can be created to forecast the effect of development plans over many years.

5. FINANCIAL RECORDING SYSTEM

Features include:

* enables detailed records of all transactions, both cash and non-cash and the sorting and analysis of this information for management purposes
* produces detailed accounts suitable for presentation to an accountant for final account preparation
* compares actual monthly income and expenditure, by category, with the forecasted figures

* produces year to date comparisons as well as total year figures with major differences highlighted
* allows estimates of taxable income to be produced based on actual figures to date and forecasts for the remaining months
* monthly forecast budget updating
* decisions on the spending pattern can be made by trying alternatives and comparing these side by side with cumulative totals
* enterprise accounts
* recorded transactions can be sorted using a number of criteria
* under stock reconciliations, physical details such as the quantity of fertiliser used on various areas can be recorded. Other reports available include detailed listings of transactions according to account type (ledger accounts), account balances, actual amounts for each account for each month, and trading accounts. A new year's monthly budget can be based on last year's actual or forecast figures or some percentage update of these.

6. INVESTMENT ANALYSIS

Analysis of multiperiod cash flows giving true interest rate, payback period and cost-benefit ratio.

7. METRIC-IMPERIAL EQUIVALENTS

Converts a range of commonly used agricultural units from metric to imperial and vice-versa.

8. MORTGAGE ANALYSIS

Calculates repayment details for any table mortgage.

9. PRODUCTION RECORDING SYSTEM

Menu-driven, database package.

* flexible on how much data can be entered under each heading
* code numbers can be used to represent inputs
* handles the collection, collation and analysis of production data for use in the decision process
* specifically structured for paddock and production plot records where the production plots can be anything from glasshouses through

to orchards

* allows the user to define the type and details of data that should be recorded
* primarily designed around recording physical information but financial data can be included as well
* specialist management reports include histories, averages and totals, searches and calculations involving dates
* reports can be designed by the user with the details of the format being stored for frequent use
* caters for recording many years information.

## GENERAL

The Kellogg Farm Management Unit at Lincoln College was established in 1980 to develop and support computer based management aids. Initial funding came from the Kellogg Foundation in U.S.A. Computer programs are available on a cost basis and all income received is put back into development and maintenance work.

As well as producing software, the Kellogg Farm Management Unit offers a fairly intensive microcomputer orientation course and serves as a general advice and troubleshooting bureau for farming microcomputer owners and prospective owners.

A criticism of Kellogg software is that a large amount of data needs to be entered by the user, which can be found to be too complicated or time-consuming. Described as well-structured programs (McKinnon 1983).

## SUPPORT SERVICES

Program maintenance and support is available at the annual cost of $60 and 6 percent of the current retail price of a package. Some of the packages are excluded.

## VII. ODIM LTD.

TANNERS POINT ROAD RD 1 KATIKATI

### HARDWARE COMPATIBILITY

Sord

### COST OF HARDWARE/SOFTWARE

| | PRICE ($) |
|---|---|
| Sord M23F mark41G (with 2x 1.2MB disk drives) | 6777 |
| 15" Prowriter C-ITOH printer | 2320 |
| Cable | 65 |
| Paper | 50 |
| Discs and spare ribbon | 100 |
| PIPS program disk | |
| BASIC program disk | |
| 'Unisys' CP/M disk | |
| 'Kiwisoft' | 1350 |
| Income/Expenses/Cash Flow | |
| 2 days tuition | |
| 1 day set up | |
| TOTAL | 10662 |

Also available is the Sord IS-11 personal portable computer (about $2 000). This is battery operated and could be useful for such operations as recording in the field or packhouse. Data entered in the IS-11 can be transferred to a Sord business computer automaticallly.

### SOFTWARE DESCRIPTION

Sord-PIPS :

* is interactive, menu-driven, fully integrated.
* is a no-programming business-orientated language.
* has nearly 60 commands to create tables, make files, retrieve and sort information, perform calculations and draw graphs.

For example :

SLIP PRINTING Lets the user print on pre-printed forms

such as sales slips or mailing labels.

AUTOMATIC EXECUTION By registering job steps executed previously, selecting the automatic command allows execution of the job again anytime.

ODIM have used the spreadsheet and database facilities of the Sord system to create software designed for kiwifruit orchard management. Other software written in PIPS, either partially, for users to complete, or complete are:

* cymbidium orchids
* avocado
* pip and stonefruit
* berryfruit
* farm finance.

Written in BASIC or other languages are:

* farm manager
* fencing
* farm report
* farm accounting
* integrated debtors and inventory system
* general ledger/debtors/creditors
* payroll (to 800 employees per annum)
* grower packing and coolstore (6 M trays)
* statistical analysis
* word processor.

The kiwifruit orchard management program is constructed on a block-by-block basis. Data recording includes orchard plans, male orchard data, female orchard data, single vine data, canopy data, crop estimates (on vine), crop record (off the vine), fruit size control, pollination, pest spray and fertiliser, irrigation and weather, labour input, and PAYE.

## GENERAL

The system is based on field data collection. As a data history builds up it is used to monitor the orchard as a business enterprise - encouraging efficiency and quality control. Denton, the developer of 'ODIM', believes in database management - that is, looking to the dollar at the source, rather than manipulations after the event to satisfy legislation.

## SUPPORT

Software updates are free (cost of program disk $25). Updates are produced at the rate of three or four per annum, and it is suggested a user may update once a year.

## VIII. PRIMESOFT/FARM PLAN (N.Z.) LTD

P.O.BOX 1838 CHRISTCHURCH

Two systems are available:

## VIIIA. PRIMESOFT

### HARDWARE COMPATIBILITY (Primesoft)

Commodore 64, Commodore 128

### COST OF SOFTWARE

| | PRICE ($) |
|---|---|
| Primesoft Horticultural Pack | 435 |
| Cashbook | 180 |
| Payroll | 350 |
| SPRIS 200 | 595 |

### SOFTWARE DESCRIPTION (Primesoft)

Menu-driven.

1. PRIMESOFT HORTICULTURAL PACK

Programs cannot be linked together by the computer. For example, the totals from the financial forecast cannot be automatically transferred to the cash flow program. They have to be written down and then typed in again after the cash flow program is loaded.

CROP PROFITABILITY MARGIN

* determines the effects of different yields, prices, and direct crop expenses on any crop
* investigates the profit levels between different crops
* performs a sensitivity analysis to show the effect on profitability of different yields and prices.

The program allows the user to enter their own areas such as row, square metre or hectare, and type of crop, income and expense headings. The

result is calculated as a return per unit area, and expenses as a percentage of income. Suitable to investigate any crop - glasshouse, orchard or nursery.

ANNUAL FINANCIAL FORECAST The program prompts for all relevant crop performance information, opening and closing crop numbers, quantities and values, sale and purchase items. All income and expense items are defined by the user. The program calculates:

* income and expenditure sub-totals
* totals for the whole property
* expected surplus (or deficit) for the year.

MONTHLY CASH FLOW PREDICTION

* calculates the expected course of the trading account month by month.

Income and expenditure figures are allocated on a month by month basis to produce the cash flow. Actual figures can be entered in place of the monthly estimates and the effect of any changes in income and expenditure to that forecast is immediately shown.

2. CASHBOOK

Enables recording of financial transactions to produce formatted reports. Records all cheques, cash payments, deposits and bank account transactions, and allocates these to user-defined account headings. Produces the following reports:

* account list
* transaction type list
* deposit entries
* payment entries
* account entries and totals
* year to date totals
* bank reconciliation details.

Up to 350 separate accounts can be used. Up to 20 different transaction types can be defined. Up to 500 transactions per period can be recorded.

3. PAYROLL

Records a wide range of information including records of each employee:

* full wage and taxation reporting facilities
* banking and cash details
* satisfies requirements under awards and PAYE
* produces regular reconciliations
* complete end of year reconciliation for the Inland Revenue Department and employees.

Will take up to 200 employees on one data disk.

4. SPRIS 200

A specialised database for the recording and manipulation of data. For example:

* lists in numeric order according to any of several traits of a recorded unit such as row, tree, or vine
* searches and sorts for a plant or plants with certain conditional criteria.

Although not as powerful as some databases on more powerful machines, 'SPRIS' can provide the grower with management data very quickly, to compare practices or identify conditions for optimum yields.

GENERAL (Primesoft)

The merger of Primary Software Ltd. and Farm Plan (NZ) Ltd. to become Primesoft Farm Plan (NZ) Ltd. has resulted in a wider range of software to offer at all levels.

Primary Software Ltd.'s software won the '1983 Cooper Farm Management Award' for ease of use and practical relevance to today's farming conditions. Primary Software Ltd. claimed to be the largest supplier of agricultural software in Australasia (Anon., 1984d). Low cost has been a key Primary Software Ltd. marketing feature.

SUPPORT (Primesoft)

Manual provided is comprehensive and reported to be well laid-out and understandable (Crook, 1983). A tutorial disk is available for the 'Primesoft Horticultural Pack' for $10.

## VIIIB. FARM BUSINESS MANAGEMENT SYSTEM (FBMS)

### HARDWARE COMPATIBILITY (FBMS)

CP/M, MS-DOS, PC-DOS
CP/M includes Altos, BBC-Torchpac, Epson QX10, Bondwell 14, ICL PC, Kaypro 2,4,10, Micro-Age Commander 402, NEC 8 000, Televideo portable, Torch, Systems 2 800.
MS-Dos includes Corona AWA, IBM PC,XT,AT, NEC APC, NEC APC111, Philips P2 000V, Sanyo MBC 550 Series, Sigma, Tandy, Wang PC.

### COST OF SOFTWARE (FBMS)

| | | PRICE ($) |
|---|---|---|
| FBMS: | Level One | 895 |
| | Level Two | 1300 |
| | Level Three | 1300 |
| Module 1: Land Activity and Costing Programs | | 700 |
| Module 4: Farm Performance Analysis | | P.O.A. |
| Module 5: Farm Accountancy Transfer System | | P.O.A. |
| Employee Record Management System: | | |
| | Payroll | 800 |
| | Harvest module | P.O.A. |
| | Work, Jobs, Contracts, Clients, Debtors | 700 |
| | Stocks and Services Management | 500 |
| | Cheque Writer | P.O.A. |
| | FBMS Integrating Facility | 200 |
| Plant Labelling | | 350 |

NOTE: Upgrading of software between levels costs only the difference between levels + a handling fee.

### SOFTWARE DESCRIPTION (FBMS)

Integrated.

1. FBMS LEVEL ONE/TWO/THREE

The 'Farm Business Management System (FBMS)' is offered at three levels

for three systems:

* for low cost CP/M and MS-DOS computer systems, FBMS level one can be bought.
* level two and three can be bought for high capacity CP/M and MSDOS systems.

All levels of the 'FBMS' are 'upward compatible'. This means that old records can be transferred onto a new computer and/or higher level 'FBMS' software, if requirements expand or the computer is upgraded. Higher levels offer greater versatility, complexity and capacity to suit the information needs of users. For example, level one includes:

* cash flow
* cashbook
* profit and loss reports
* production reports
* transaction listings
* analysis and administration programs.

'FBMS' is a result of a farm record book which allowed growers to keep a cashbook and to extend the transactional details into other headings. It enables all relevant details of those transactions - quantities, weights, unit values and unit prices to be tabulated and monitored.

* actual values can replace predicted costs and income to give an accurate budget and an updated budget forecast.
* data is on a one-entry basis.
* programs are block-based. Operations are planned on a block-by-block basis. Reports may be produced on a block-by-block basis or on the property as a complete unit.

Individual gross margins from a block can be produced on a per hectare basis.

2. MODULE 1: LAND ACTIVITY AND COSTING PROGRAMS

Allows detailed block records and analysis of these for information such as rotation management and variety comparisons.

3. MODULE 4: FARM PERFORMANCE ANALYSIS

A 10-year summary management system to allow for correlation between past information of farm production and activities, and present farm

activities to aid planning.

4. MODULE 5: FARM ACCOUNTANCY TRANSFER SYSTEM

A program to assist with the production of accounts, including the annual balance sheet and taxation returns, from farm data. Designed for transfer of accounts via a floppy disk to an accountant's computer system.

5. EMPLOYEE RECORD MANAGEMENT SYSTEM

May be used separately from, or integrated with, the 'FBMS'. Comprises of five modules which can be integrated with each other:

PAYROLL a flexible and detailed payroll to cope with many different payment and taxation options. Reports include:

* pay advice slips
* employee personal, pay and taxation records
* employee work record
* IR12D printing.

HARVEST MODULE FOR PAYROLL DATA ENTRY designed for payment of employees on a contract price basis, where the pay rate is dependent on the quality of the harvest unit at grading.

WORK, JOBS, CONTRACTS, CLIENTS, DEBTORS allows for detailed analysis of work performed by employees and for the charging of work done.

STOCKS AND SERVICES MANAGEMENT for stock reporting and control, and charging for stocks and services.

CHEQUE WRITER

GENERAL (FBMS)

The 'FBMS' has been described as a New Zealand based and developed system arising from precomputer farm management practice (Crook, 1983). Lissaman, a principal for the company, says that the software is primarily for comprehensive farm/orchard business management. As a

consultant, Lissaman maintains that the grower must be able to present the advisor with as complete a picture of the whole operation as possible; by recording.

## SUPPORT (FBMS)

Training takes up to 2 hours. Requires some individual setting up to suit individual farming situations.
Follow-up services and assistance is provided.
The 'FBMS' is very flexible. It can be adapted to the level of complexity required to suit a grower's needs and serve the requirements of any business.

## FUTURE DEVELOPMENT

A system to produce product labels suitable for nurseries will be included by the time this paper is published.

Two additional packages are under development for release by Andas Computer Centre and Compucation Systems. Preliminary information is supplied in IX and X:

## IX. ANDAS COMPUTER CENTRE

234 CASHEL STREET CHRISTCHURCH

### HARDWARE COMPATIBILTY

Apple IIe: 5 or 10MB hard disk

### COST OF HARDWARE/SOFTWARE

| | PRICE ($) |
|---|---|
| Nursery Computer Pack | 2 000 |

### SOFTWARE DESCRIPTION

1. NURSERY COMPUTER PACK

Debtors/stock control/plant labelling program for wholesale nurseries. Development is by Mr B. Enslie.

## X. COMPUCATION SYSTEMS

24 WHARF STREET BOX 574 TAURANGA

### HARDWARE COMPATIBILTY

Apple Macintosh: 512K RAM
5MB hard disk

### COST OF HARDWARE/SOFTWARE

| | PRICE ($) |
|---|---|
| Kiwi Manager | 2995 |
| Hardware | 13700 |

### SOFTWARE DESCRIPTION

1. KIWI MANAGER

Coolstore/Packhouse Management System: System to retain and view a season's coolstore and/or packhouse information. Reports include:

* stock in store
* stock handled to date
* fruit by grower
* fruit by exporter
* loadouts this month (or any month)
* fruit in this month (or any month).

Capacity to store information on over 1M trays. This may be greatly increased by alternative hardware configurations.

# 4.0 ADOPTION AND USE

## 4.1 GROWERS' USE OF COMPUTERS

Oliver (1985) surveyed 183 farmers which included 19 horticulturists. Respondents as a whole reported cashbooks, budgeted cash flows and whole farm budgeting the most highly rated and used functions of their computers followed by word processing and less importantly gross margins and livestock breeding records. Microcomputers were also used for payroll and PAYE ('Pay as you earn' taxation), paddock records, livestock records, feed budgets and other unspecified purposes.

Over 88 percent of respondents expected to benefit from more efficient record-keeping while nearly three-quarters anticipated benefits from more information and the identification of profitable production practices. Both time savings and cost savings were also important benefits. More than three-quarters of the total respondents found a computer useful for the following specific applications:

* comparing actual results against budgeted results (85 percent of respondents)
* credit control (81 percent)
* searching for particular items (78 percent)
* forecasting taxable income (77 percent).

Fifty-six percent of respondents found a computer useful for enterprise analysis. Seventy-seven percent have the printed output used by their accountant.

Computers can be used to perform calculations to allow the extrapolation of data values from a trend line; for example, best fit curves, deviations of actual values from the curve, correlation coefficients and confidence level probabilities. Based on historical data, information such as optimum tree crop loadings could be estimated to provide a scientific base for estimating fruit thinning.

Computerised management information systems provide the potential for grower comparisons. Studies in New Zealand have shown that performance comparisons between homogenous groups of growers can provide the basis for improved grower decision making. This may eventually lead to the

formulation of performance standards and agreement on a common industry approach to information requirements.

The logical sequence of inputs and steps in using a computer for data handling aids a grower in structuring decisions and following a format or plan.

## 4.2 INTEGRATED SOFTWARE

In business, the purpose of integration is to bring the major computing applications together. Integrated software accounts for nearly half of all business software sales (Anon., 1985b).

Although there are many integrated programs now available for general business applications, the market has been lead by Lotus Development Corporation's 'Symphony' (U.S.A.) and Ashton-Tate's 'Framework' (U.S.A.). The degree of integration differs between programs. 'Symphony' and 'Framework' among many others have been described as fully integrated. Programs of this nature require complex file structures and the ability to interact between applications without leaving the active program. For example, on Software International's 'Open Access' and BPI Systems' 'Aura', spreadsheet data can be transferred to a graph by indicating the appropriate graphics file as the receiver of this data.

Another way to achieve integration is the use of operating environments such as:

* 'TopView' (IBM)
* 'Desq' (Quarterdeck)
* 'Core Executive' (APX).

The purpose of an operating environment is to provide an interface between the user and the computer that will allow data exchange and other unique applications between programs. Completely independent programs developed by several vendors can be loosely integrated with a universal manager program which supervises operations. They do not attempt to provide a total user interface to provide continuity of interaction with different programs; they simply provide windowing and the facility for data transfer between applications. Operating

environments enable users to enjoy the functionality associated with integrated programs, while continuing to use the programs with which they are already familiar.

The future of microcomputer software lies with the development and availability of integrated applications.

## 4.3 SOFTWARE CASE STUDIES

A number of horticulturists were surveyed for case study information on computer use. Seven of these are documented below. No horticulturists were located who use total systems offered by companies described in the computer software survey (Section 3.0).

1. An Ashburton company, Winslow Berries, uses a range of management software from Microage (N.Z.) Ltd in Christchurch. For pure record-keeping and monitoring they have found standard industrial systems to meet their needs. The only modification was to the payroll/job costing to incorporate piece rates. The system comprises:

* debtors system
* general ledger
* payroll/job costing
* stock control package
* creditors system
* 'WordStar' (word processing)
* 'Supercalc2' (cashflow budgeting)
* 'Datastar' (record-keeping of workers).

2. Stevens, a Katikati horticultural consultant and grower, has purchased an integrated spreadsheet, wordprocessor, database, graphics and communication package called 'Framework' (Ashton-Tate, U.S.A.). His work involves a range of jobs from block supervision to cash flows and feasibility studies. The package is flexible and powerful and has impressed Stevens as very suitable for horticultural applications. Before purchasing a system, Stevens prepared a comprehensive list of requirements, which included in general terms the functions of:

* word processing
* spreadsheet
* database

* financial recording system
* diary package
* data logger and microprocessor control
* property plan drawing
* orchard performance analysis
* packhouse and coolstore system
* wages
* linear programming
* videotex

3. A Hawkes Bay horticultural consultant and property manager, Graham, purchased an Apple 'Macintosh' in 1984. Graham considers that the $9 000 system which includes a 'Multiplan' spreadsheet, an IMS wages package and a wordprocessor had paid for itself within six months. The most valuable use has been in cash flow and budget preparation.

4. Aalders, an accountant and partner in an export flower property in Kumeu, is very enthusiastic about computer usage. He adapts business software to suit his needs. As well as applying a computer for general production, financial and market recording and analysis, Aalders emphasises labour recording and analysis. Labour costs account for up to 80 percent (Thiele, 1972) of the total costs on a horticultural property, and deserve greater recognition in management control.
Aalders and Ruge (his partner) keep their operations separate by operating separate blocks. Both employ the same labour gang but divide labour costs to their respective blocks or operations.

Aalders measures labour input by means of a timesheet. This gives:
* employee's name and number
* for which partner the employee works.
* on what block or operation the employee works.
* the exact task.
* how long the task takes.

Information from this allows the partners to:
* divide the costs accrued by their own blocks
* compare the performance of each employee
* locate discrepancies in block costs
* compare whether labour costs should be substituted with capital intensive costs

* measure weekly the crop return related to harvesting costs
* determine the labour component in the total production cost of a flower
* calculate relative cost factors between different species, lengths and grades of blooms produced.

5. Tripp uses an Apple 2e with general business packages (IMS 'Ascent') for financial control of his large, Hawkes Bay, cut-flower property. Debtor, creditor and inventory recording are in use with a ledger recording system being considered to handle the goods and services tax. A 'Visicalc' spreadsheet is used to prepare a 24-month budget forecast. The uses of the system include:

* capital investment planning
* timimg purchases for reducing taxable income
* recording data to enable accurate, historically-based production and market planning.

6. A Richmond orchardist, Etherington, records the major advantages of computerisation:

* considerable time savings
* more accurate information
* information more readily available.

Etherington is considering upgrading a five-year-old computer system. The current system comprises an Apple 2+ with general ledger, payroll/timesheet, wordprocessor and database. An updated system, he believes would ideally include:

* general ledger
* payroll
* debtors/creditors
* spreadsheet
* wordprocessor
* communications
* database
* stock control (nursery)
* cash flow
* suitable software for monitoring production

all integrated.

7. Saunders, a Hamilton horticulturist

"would not consider operating without a computer...

> The computer saves neither time nor money, but the additional current information available to us as a basis for decision making is invaluable."

Three descriptions from literature of the advantages of computer use are presented below:

Williams (1984), in recording the advantages of the use of a computer on his orchard near Motueka, writes:

> "(computerised systems) have become an essential and established part of our management practice.
> We are now much more aware of the cost effectiveness of all departments of our organisation and, as a result, we are able to set management objectives and to monitor progress toward those objectives with so much more confidence and awareness."

A Southland nursery (Cruikshank, 1985) claims benefits from computer usage include:

* identification of uneconomic lines
* price increases of inputs are easily translated to individual products
* computerisation is perceived as a professional approach to office contact by customers and the bank.

There are many overseas examples of computer usage by growers in horticulture. One of these, Brolick, president of a 3500 acre nursery in Michigan believes the computer is the most significant tool in the nursery (Urbano, 1983b). It has freed employees from boring routines, improved employee morale and customer relations, reduced human error and allowed expansion.

## 4.4 EXAMPLES OF SOFTWARE DEVELOPMENT AND APPLICATIONS

Development is taking place in computer usage for:

* predicting crop maturity dates (Anon., 1984b)
* plant protection models (Schenk, 1983), (Banes, 1984), (Mackay, 1985)
* weed control models (Skroch, 1982)
* climate regulation technology and the use of plant growth models (Schenk, 1983)

* landscape architecture (Bishop, 1984)

Examples of development and applications in business management software are presented in the following section:

An inventory of Australasian agriculturally-orientated software was published by the Queensland Department of Primary Industries (Mill, 1982). Software for microcomputers in this inventory includes:

* a linear programming package
* 'EVAL'. For assessing the profitability of individual farm development projects. Calculates internal rate of return, net present value, payback period, gross and net benefit-cost ratios, postponality indices.
* 'HAC Machinery Investment'. An interactive program to compare the cost of: machinery ownership against a contractor
  different sizes of machines
  different machinery combinations.
* 'Vineyard Reconstruction Model'. A budget to simulate the returns and physical structure of a vineyard during replanting and reconstruction.

An American publication, (Anon., 1984c) describes a range of software produced for use on IBM microcomputers. Many of these have potential applications in horticulture. Planning models include:

* economic cost analysis using present-worth
* CPM (critical path method)
* PERT (performance evaluation and review technique)
* decision tree analysis
* linear programming
* mixed integer programming
* quadratic programming
* single state variable programming (dynamic)
* nonlinear integer optimisation with inequality constraints
* simulation model-building language for complex multi-equation models.

Some programs with these functions are currently available in New Zealand, for example 'Projecta', an IBM critical path method program. Other programs may be available from the United States. While many of these are complex applications, they have modest hardware requirements.

Most run under PC-DOS on the IBM PC and IBM XT. Memory requirements range from a basic 64K main memory to 192K with two 320K diskette drives and an 8087 numeric co-processor. Prices range from US$40 to US$400.

In the United States, a number of nursery software packages are available, particularly in inventory control, general accounting and management. An example of a complete business package is the 'Horticultural Business Management Program', designed for nurseries, garden centres and other horticultural companies (Urbano, 1983a). This is offered in the United States by Ball Technical Services, West Chicago, Illinois. Aspects of the program applicable to New Zealand horticulture include:

* 'Plant Master' program
  - crop rotation planning
  - space management
  - labour scheduling
  - crop profitability analysis
  - purchase requirements
  - order processing
  - inventory control.
* 'Grofile' (designed for booking sales in advance)
  - crop sales availability
  - shipment scheduling
  - order processing
  - inventory control.

## 4.5 WHAT IS THE ATTITUDE OF GROWERS WHO DO NOT OWN COMPUTERS?

Responses to a survey (Ryde and Nuthall, 1984) indicated a positive view of microcomputers, as an aid to management, is held by many farmers. Sixty percent of farmers surveyed believed a microcomputer would at least be of some use on their property. When interpreted in light of farmers lack of experience with microcomputers, it can be recognised that this is a very positive attitude to an innovation. Nearly two-thirds of all respondents believe they will purchase a microcomputer.

Hughes (1983) concluded that farmers lack of knowledge contributed to not owning a computer. Farmers:

* are aware of the technology
* lack hands-on experience
* feel that they not have time to learn how to use a computer and decide which one suits their enterprise
* have the attitude that it is easier to ignore the technology and leave it to the next generation.

John Lay, a farmer and Lincoln College lecturer, cites a number of reasons for farmers not purchasing microcomputers. These are:

* fear of technology
* orientation not to become office-bound
* leave to the next generation
* concern it will take up too much time
* unjustifiably scared it will be too difficult
* associate computers with intellectuals and the misconception that they have to learn to program
* farmers are not dexterous with keyboards.

Stevens, a horticultural consultant, suggests growers are starting to become a lot more aware of what computers can do. He is sure there will be an upsurge in their use.

## 4.6 ADOPTION OF MICROCOMPUTERS BY GROWERS

The increasing usage of microcomputers in horticulture at property level is inevitable. Factors delaying adoption include:

1. LACK OF HOW-TO KNOWLEDGE

Growers are aware of computer technology but lack hands-on experience. Because the technology is new to farming, growers have little experience in defining and selecting computer systems. This total lack of experience inhibits grower acquisition, even although their value may be perceived.

2. UNFAVOURABLE PERCEPTION OF THE ATTRIBUTES OF MICROCOMPUTERS.

To be adopted most innovations must be economically profitable, but sociological variables have a bearing as well. It is the grower's

perception of the relative advantage, compatibility, complexity, trialability and observability of microcomputers that affect their rate of adoption.

Relative advantage: This is the extent to which a farm computer is perceived as better than the present system of recording and analysis. It is often expressed as economic profitability. Surveys by Oliver (1985) and the Dairy Board (Crabb, 1984) revealed that 75 percent of farmers considered their computer to be cost effective. Relative advantage will vary between properties. As management information systems for horticulture become more sophisticated, computer usage and awareness of business management techniques will increase.

Compatibility: Horticulturists are aggressively pursuing new tools to improve productive efficiency and cost effectiveness. Several factors however reduce the compatibility of microcomputers for horticulturists:

* growers values tend to be more compatible with mechanical innovations and with those that increase production directly
* growers have yet to see the package that does things the way they think
* a low level of management and small property size
* computers impinge on the 'kitchen table' environment for doing office work which is still quite common.

Complexity: Ryde and Nuthall (1984) found that the higher the level of formal education, the more likely would a computer be purchased. Efforts to make computers more 'user friendly' will gradually improve confidence. With the technical jargon and intellectual aura associated with computers, many growers are leaving computers for the next generation. The simplicity of operating a microcomputer requires that this psychological barrier be overcome.

Trialability: Microcomputers cannot be tried on a limited basis. The application of a computer system to horticultural management requires a significant financial and time commitment to initiate. Ongoing benefits increase with time as processes are refined and records improved. Compared with investment in other horticultural technology, for example mechanical harvesters or frost protection, the amount of money needed to adopt computer technology is relatively small.

Observability: While computers are physically tangible, the effect of their use on decision making is not so tangible. Growers may be immediately aware of another grower's crop training structures but new methods of farm record keeping are not as obvious. This lack of direct observability has retarded the adoption of farm computers.

3. SHORTAGE OF GROWER-ORIENTATED SOFTWARE.

The diversity of horticultural systems makes it difficult to provide software for this market and the number of horticultural properties is small in relation to agriculture in New Zealand (6 percent in 1982).

The authors believe growers' software needs will best be met by a complete, integrated system. An important development is the increased cost-effective memory capacity of hardware, thus reducing memory requirement as an obstacle to complete software systems.

The provision of software is complicated by the many models of microcomputer available and subtle differences between models of the same brand. Nuthall (Anon., 1985a) found in a survey of farmers that respondents used 57 different types of microcomputer.

4. LOW PROFILE OF NEW ZEALAND SOFTWARE PRODUCERS

Adoption of microcomputers will be slow unless horticultural software producers establish a higher profile and pursue sales with a complete horticultural system to offer. The release on the market of systems by Yates Farmfax and AWA Ltd. may fill this gap.

5. LACK OF COORDINATED DEVELOPMENT.

The full potential of using a computer cannot be attained unless the industry works to achieve that potential. The grower, not the computer system, is the critical ingredient in the successful use of a computer on the farm.

Nuthall (1985) states:

> "There is a need for a coordinated development program. This will require a solid commitment, both in principle and in cash resources, from the

> government as well as educational institutions. A framework must be evolved and specialist groups for each application area set up now. The alternative is a lot of individuals, including the semi and self trained, each producing his own thing, resulting in duplication and wasted resources. This is untenable."

The objective of the Kellogg Farm Management Unit is to create and supply computer-based management aids to the New Zealand farmer. Organisations in a position to coordinate development of the industry include the Kellogg Unit as a quasi-public body, and the MAF National Info-systems Centre.

Educational institutions such as Lincoln College and Massey University could be involved in coordination, particularly to develop biologically, economically and technically integrated systems. In the United States, state universities are in the forefront of farm software development. New Zealand is of a size where coordination of microcomputer based systems is possible and important for the horticultural industry and the individual grower.

In a wider sense, de Groot, a Christchurch computer consultant and asparagus grower, is critical of the failure of the hardware manufacturers to develop compatibility between machines. The future he feels, will see the development of a distributed system, where floppy disks are carried from one computer to another. For example, a disk containing a grower's financial data will be taken to the accountant for processing. Compatibility is essential for this. In the long-term the networking of microcomputers through the telephone system is likely. Hardware compatibility is essential too, for systems to be able to communicate with each other.

## 5.0 CONCLUSION

The authors believe there is an increasing awareness by the horticultural community about what computers can do, which will lead to increasing use. However, because growers are unaware of the specific, potential benefits, and ignorant of what is available, they do not know what they want. Software producers must aggressively market their products and encourage growers to gain hands-on experience.

There are several reasons to believe that the microcomputer will soon be adopted more fully as a management tool by the horticultural industry:

* computer prices are falling at the same time as their technological capabilities are increasing
* microcomputers are becoming much easier to use than those which preceded them
* good farm management is critical for survival in today's economy.

There are horticultural enterprises which will not benefit directly from the use of a computer. If a grower is not seeking accurate and timely information and is achieving his/her objectives with an intuitive approach, there will be no essential, perceived need.

Concerns most likely to benefit are large horticultural properties such as large orchards, properties with specialised operations which require extensive physical records and consultants.

Several companies are offering comprehensive horticultural systems available throughout New Zealand.

The more subjective elements of decision making remain as important as ever. However, where the assessment has involved computerised aids, the basis of some of the important elements will be more comprehensive, accurate and sensitive to the up-to-date circumstances of the property. A computer system will allow a manager to budget and make decisions previously inhibited by a lack of information.

The next five years will be a period of rapid development, with the possible introduction of MAF-based videotex management services, the establishment of the horticultural software market and the more widespread acceptance of on-farm computers.

The horticultural office has lagged behind in the rapid technological development of the computer industry over the last decade. This is changing.

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