"Next Generation" Integrated Orchard Management Software

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Project Number: MT06063

MT06063

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FINAL REPORT

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MT06063
"Next Generation Integrated Orchard Management Software"

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By

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For

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MT06063 "Next Generation" integrated orchard management software

Horticulture Australia Project Number: MT06063

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Purpose
This report is the Final Report of the project known as MT06063 *"Next Generation" integrated orchard management software.*

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Confidentiality Request
This report is not confidential

Contents

1. **Media Summary**

Like many industries, the Australian fresh produce industry is in a state of rapid change. Massive consolidation of supply is occurring with growers amalgamating into various forms of supply chain to give them a critical mass of product with which to supply large customers – either on domestic markets or overseas.

As this consolidation occurs new demands are put on the chain. These include;

- A new, higher level of **production information** is required. Varieties, volumes, timing etc etc need to be listed for each orchard and then integrated across the chain.

- Stronger **price pressures**. For fruit, around 50% of the total cost of production is incurred in the orchard. To be competitive there is now very strong pressure to better manage orchard-related costs (such as labour, chemicals, fertilizer, water, fuel etc) while still achieving a high yield and a high packout percentage of the sizes the customer desires.

- **Food safety and environmental obligations** become paramount. A supply chain with a number of suppliers cannot risk being denied a market due to a food safety violation by one orchard. Similarly, major retailers are rightly demanding more and more evidence of appropriate chemical use and environmental stewardship.

OzProduction, now part of the Holman Fresh supply chain, has worked with Sumo Software to develop a "Next Generation", of integrated orchard management software that allows the capture and reporting of the data needed to respond to the pressures described above.

Know as the **"igrow" Orchard Management System** the new system is web-based for multi-user access, intuitive to use, and integrates data across various orchard operations.

For example once a tractor is "set up" on the system (i.e. its operating parameters are entered into the system) it can be used (without further data entry) by the system for all appropriate orchard operations - tree spraying, weed spraying, mowing etc etc.

Igrow allows the printing of simple "Job Sheets" from the system that can be given to orchard staff specifying the execution of the task. For example, in spraying, the job sheet, printed from the system, will prescribe the product, rate and number of vats required to spray the block as well as the tractor, gear and engine revs to be used. In one operation the manager captures the data related to the task, completes the orchard's spray diary and instructs the worker. A truly integrated operation.

A wide range of reports can be produced by igrow and these can be tailored to various orchards. Operating costs can be reported in $/ha, $/tree or $/kg of fruit produced.

OzProduction and Sumo Software intend to make the program available to other orchards and supply chains.

2. Technical Summary

The project developed the igrow Orchard Management system.

From an **operations** view point, igrow:

- **Integrates** people and machines across various aspects of orchard management, across various orchard blocks - just as happens in real life. Once a person, machine or orchard block is set up on the system, they can be used for any application.
- Is **intuitive** to use. Input screens are similar and only request information related to the task at hand (other data is entered once only in setting up people, machines and blocks etc)
- Is **interactive.** igrow can accommodate many users at one time and can potentially interact with suppliers to manage inventory of their product at the orchard. Managers can have remote access to the system to program tasks and check on progress.
- Provides outputs (reports) similar to the following (reports are tailored to the specific application) in a secure (from unwanted external access) environment
  - spray diary records for insecticides, fungicides and herbicides,
  - records of fertiliser use
  - recording of employee labour by task and then orchard/block/variety etc
  - records of input purchases and inventory tracking
  - forecasting and budgeting of labour and management tasks
  - reports for the above

The technologies used to implement the igrow website can be broken into the following three tiers.

Database: MS SQL Server is an enterprise level database which is used commonly in large websites and can cater for thousands of website visitors. MS SQL Server was chosen for its performance and is well supported by Microsoft. The database is capable of storing millions of transactions and should provide more than adequate performance. Further information regarding this database can be found here http://www.microsoft.com/sqlserver/2008/en/us/default.aspx.

Application Server: Adobe ColdFusion is an application server used to drive dynamically generated websites. Its main purpose is to push and pull data from the database to the end user's web browser. ColdFusion is also an enterprise level product and can server many thousands of users. For further information about Adobe ColdFusion please visit http://www.adobe.com/products/coldfusion/.

Website: Has been written in Adobe Action Script 3 (AS3) and has been developed using the Adobe Flex/Adobe Flash applications. AS3 is a full object oriented programming language and is very similar to java in its syntax. Sites like YouTube incorporate this technology for its high performance abilities to steam data, including video. For further information about Adobe Flex please visit http://www.adobe.com/products/flex/.

Working together these technologies provide the igrow website with:

1. High performance.
2. The ability to scale to thousands of end users.
3. Access to the latest technology used to build today's dynamic, rich and interactive websites.

For example a future update may include video clips, providing end users with tutorials on getting around the igrow website as well as tutorials related to orchard tasks etc.

3. Using igrow

The following pages represent a high level user manual for igrow. The system itself can be accessed (until this final report is approved) at http://www.igrow.net.au
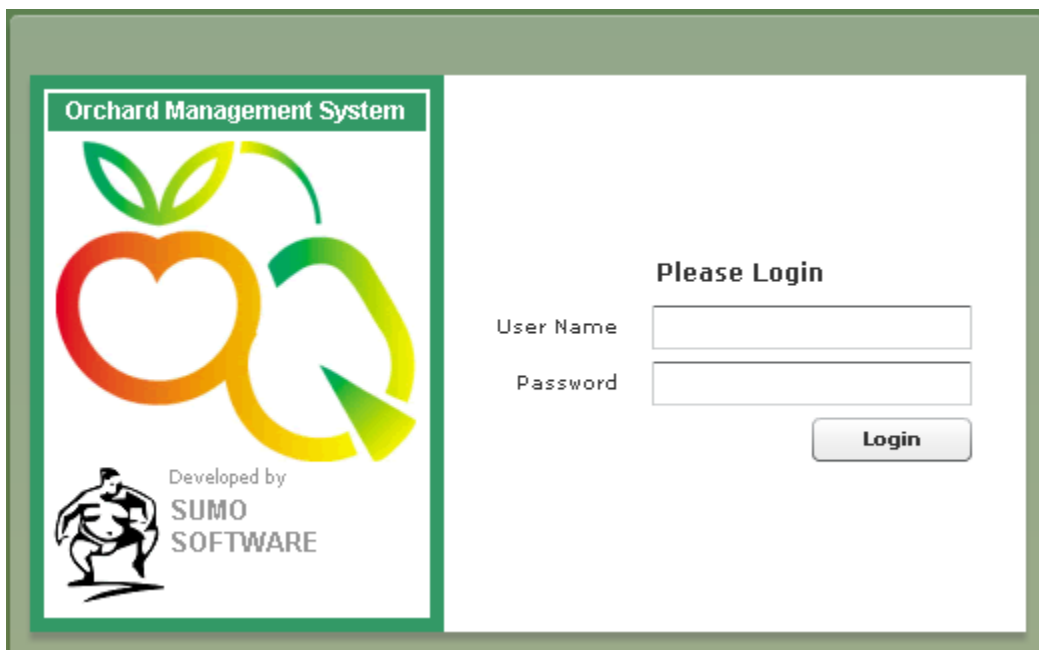The user name is "a" and the password "a"
Note that the site and these access details are **confidential**.

3.1 Login

Each user will be required to login into the application with their username and password.

Please see the database administrator if you have not already been supplied with these details.

3.2 Getting Around

The application is supplied with a menu bar located at the top of your display. This feature is commonly found in many MS Windows based applications and is used to navigate the various functions and reporting options of the application. To use the menu bar, select the required option with your mouse.
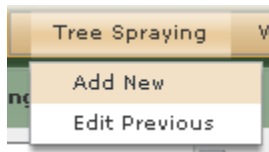

3.3 Getting Started.
 (Creating a new Tree Spraying record.)

As a lot of features are commonly found across the application, once you are familiar with one function (tree spraying for this example), the other functions will feel like the first. So let's get started in adding a new Tree Spraying record.

1. Click Tree Spraying > Add New on you menu bar.

2. Select the Category and Date that you require. For this example, we'll select Disease Spraying. Once you have entered the Category and Date, click Continue.

You will now see a screen similar to the following.

3. Adding Block(s).

Let's now add the location that will be sprayed, which is referred to as the Block ID. Please click on the icon with the plus (+) symbol located to the right of your display as pictured.

Clicking this button will display the following block selector form. The block selector form is found throughout the application and is accessed via this method.

This form is used to select one or more blocks to which you are assigning your function (tree spraying in this case).
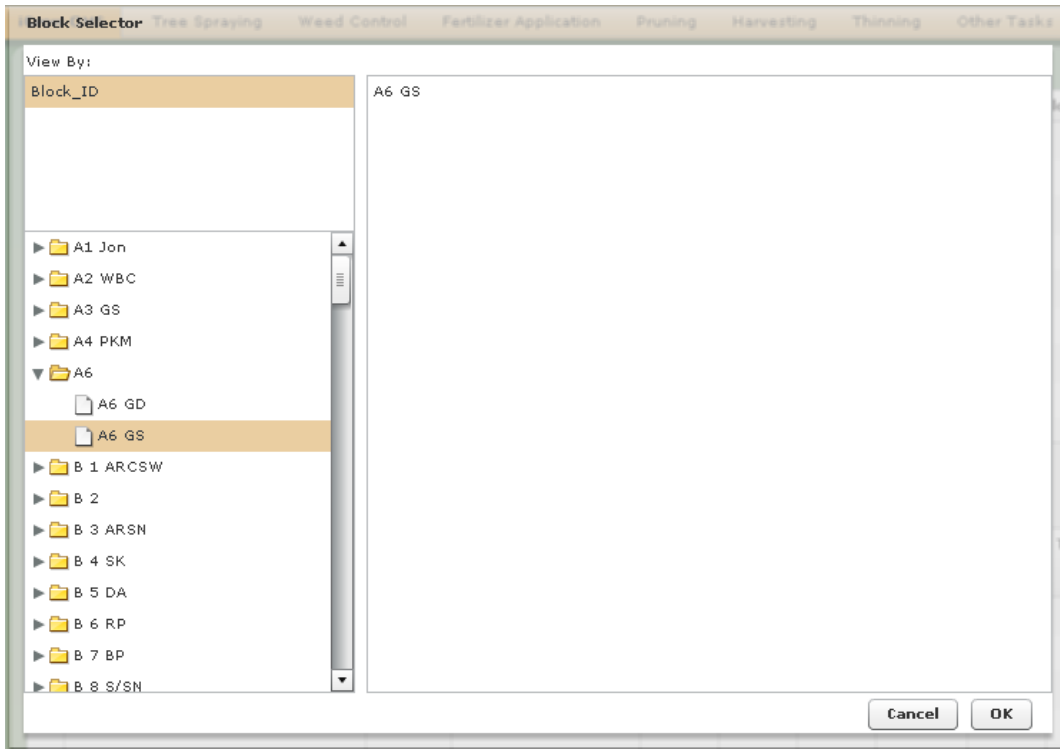
To select a block, click the option Block ID in the 'View By' list, and then select your block from the available list which has now appeared. The block or blocks you have selected will appear in the list to the right. Should you make a mistake, you can double click on any of the blocks previously selected to remove the block.

4. Adding chemicals / fertilizers.

Chemicals and fertilizers can be added by clicking the 'Chemicals/Fertilizers' option found to the left of you display, about midway down.
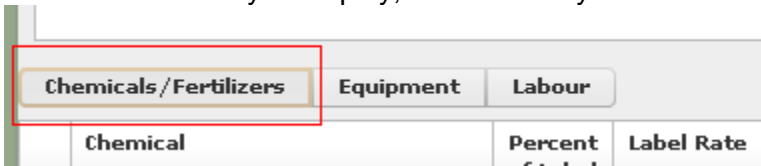
Each of these options will have the following buttons available in the bottom right hand of the display for adding, editing and deleting.

Click the (+) button to add a new chemical / fertilizer. The following form will be displayed.

Press the Tab key to move the cursor to the Chemical drop down box.
For this example, we will select 'Kocide Blue Extra' by typing the letter 'K'. The drop down box immediately selects the first chemical in the list that begins with the letter 'K' which is also Kocide Blue Extra'. You will also find any information that has been preset in the database for this chemical to also appear as follows.

You may adjust any of the editable fields as required. Once you have finished, click the Add Record button at the base of the form to add this selection to your tree spraying record. You will then be returned to the main Tree Spraying form, and you should now see the chemical you have added in your chemical/fertilizer list as below.

	Chemical	Percent of Label Rate	Label Rate
🗑	Kocide Blue Xtra	100 %	2Kg Per 100L

(Tabs: Chemicals/Fertilizers | Equipment | Labour)

A similar process is then used to create a record of the machines used for the task and the labour applied to the task. These are completed by clicking on the "Equipment" and "Labour" button next to the "Chemicals/Fertilisers" button.

5. Printing Work Instructions
Note that as soon as a record is created it can be printed to provide a work instruction to operational staff (see next page, below). Note also that the work instruction is signed by both the operator and the manager to create an audit trail for the task.

The rest of the database - the screens for weed control, fertilizer application, pruning, harvesting, thinning and other tasks -   is used in a similar way.

It is that simple!

3.4 Program Setup

Like other databases of this type there is a need to "set up" various parameters used in the database. Once so set up, the parameter can be used over and over with the same set of characteristics. Some of the parameters that need to be set up include

- Fruit types
- Varieties
- Orchard blocks,
- Machinery
- Staff

Setting up is achieved by completion of various tables. Examples are given below. Note that setup need only be completed once.

3.4.1 Set up of fruit types

FT_ID	Fruit_Type
1	Apple
2	Apricots
3	Cherry
4	Mixed
5	Nectarines
6	Olives
7	Peaches
8	Pear
9	Persimmons
10	Plums
11	Pluots
12	Stonefruit

3.4.2 Set up of varieties

V_ID	Variety	FT_ID	Available
1	A38-039 Yellow	5	True
2	Abbas	1	True
3	Amber Jewell	10	True
4	Angelino	10	True
5	Arctic Pride	5	True
6	Arctic Queen	5	True
7	Arctic Snow	5	True
8	Arctic Sweet	5	True
9	August Red	5	True
10	Autumn Giant	10	True
11	Autumn Snow	7	True
12	B016-083 Yellow	5	True
13	B16-091 Yellow	5	True
14	Beurre Bosc	8	True
15	Black	6	True
16	Black Amber	10	True
17	Blue Gusto	11	True
18	Braeburn	1	True
19	Bright Pearl	5	True
20	C2-092	5	True
21	C7-053	5	True

3.4.3 Set up of orchard blocks

Block_ID	Parent_ID	Start_Date	End_Date	Variety	Part_Block	Orchard_Name	Ha_of_Block	Trees	Tree_Spacing	Rows	Row_Width	Number_of_Irrigation_Emitters	Litres_per_Hour_per_Emitter	Year_Planted	Polinator	Comment	Earliest_Harvest_Date	P
A6 GS	A6	12/10/2006		Granny Smith	True	Warners	26	110	2		6				False			
A6 GD	A6	12/10/2006		Golden Delicious	True	Warners	11	8	2		6				False			
X 1 WBC	X 1 WBC	1/01/2000		WBC	False	Alexander	6.11	1880	2		5.7				False			
Q 1 204	Q 1 204	1/01/2000		Tatura 204	False	Quambi	6.03	8045	2		5				False			
K 2 P L	K 2 P L	1/01/2000		Pink Lady	False	Walkers	4.92	4537	2		5				False			
T 3 PKM	T 3	1/01/2000		Packham	True	Tyneholm	4.83	1487	2		6				False			
B 3 ARSN	B 3 ARSN	1/01/2000		Arctic Snow	False	Southern Summer Fruits	4.64	4644	2		5				False			
B 1 ARCSW	B 1 ARCSW	1/01/2000		Arctic Sweet	False	Southern Summer Fruits	4.64	4644	2		5				False			
R12 204	R12 204	1/01/2000		Tatura 204	False	Rosebank	4.16	1979	2		6				False			
R13 PKM	R13 PKM	1/01/2000		Packham	False	Rosebank	4.02	1350	2		6.2				False			
O 3 TQ	O 3 TQ	1/01/2000		Taylor Queen	False	Oakmoor	3.98	4826	2		5.5				False			
R 4 PKM	R 4	1/01/2000		Packham	True	Rosebank	3.73	1110	2		5.8				False			
B14 PKM	B14 PKM	1/01/2000		Packham	False	Sprunts	3.73	7457	2		5				False			
X 6 GS	X 6	1/01/2000		Granny Smith	True	Alexander	3.6	1791	2		5.8				False			
B18 202	B18 202	1/01/2000		Tatura 202	False	Sprunts	3.5	4669	2		5				False			
X 4 WBC	X 4	1/01/2000		WBC	True	Alexander	3.37	1256	2		5.7				False			
X 2 PKM	X 2	1/01/2000		Packham	True	Alexander	3.37	1256	2		5.7				False			
X17 GS	X17	1/01/2000		Granny Smith	True	Alexander	3.31	2721	2		5.8				False			
B11 PL	B11	1/01/2000		Pink Lady	True	Sprunts	3.21	3210	2		5				False			
X 5 GS	X 5	1/01/2000		Granny Smith	True	Alexander	3.16	720	2		4.9				False			
O 5 PKM	O 5	1/01/2000		Packham	True	Oakmoor	3.1	3430	2		4.5				False			
R 2 WBC	R 2 WBC	1/01/2000		WBC	False	Rosebank	2.97	940	2		6				False			
R 7 A38039	R 7 A38039	1/01/2000		A38-039 Yellow	False	Rosebank	2.82	2850	2		5.5				False			
O13 RV	O13	1/01/2000		Rival	True	Oakmoor	2.65	140	2		5.5				False			
X11 WBC	X11	1/01/2000		WBC	True	Alexander	2.64	814	2		5.7				False			
R 9 B16091	R 9 B16091	1/01/2000		B16-091 Yellow	False	Rosebank	2.56	2736	2		5.2				False			
B10 PKM	B10 PKM	1/01/2000		Packham	False	Sprunts	2.46	4912	2		5				False			
B 4 SK	B 4 SK	1/01/2000		Snow King	False	Southern Summer Fruits	2.4	2400	2		5				False			

4. Discussion

Integrated design

A key feature of igrow is the integrated nature of its design which in a sense mimics real life. Once the characteristics of an orchard input (e.g. chemical or fertiliser), machine, person or orchard block are "set up" on the system, all these parameters can be used, as appropriate, to manage the orchard. In doing so a record is kept of the inputs used, the machines used the people used and the orchard on which the work was carried out.

Records are also kept of the yield of fruit from the orchard so that the cost per hectare, cost per tree, or cost per kilogram of fruit produced can be calculated.

Other aspects of interaction are demonstrated in

- the fact that withholding dates for agri-chemicals automatically come up on the picking task sheet so that the manager can instantly see that the withholding period has passed before picking begins.
- The equipment task drop down list for (say) weed spraying only includes equipment relevant to weed spraying
- The system integrates all inputs (insecticides, funcicides, herbicides, thinning chemicals etc) into the spray diary for the block

As far as possible, igrow mimics real orchard operations. This would not have been possible without the "hands on" involvement of senior management of OzProduction in the design and testing of the program.

Benchmarking applications

One of the less obvious but very important uses of igrow is to use the data generated to benchmark productivity between growers, orchard blocks, varieties, chemicals etc.

Once the data for a series of orchards has been captured using the igrow system it can be analysed in a number of ways. Igrow's ability to record costs on a per hectare, per tree or per kg of fruit produced makes this very easy. Comparison of the costs per ha and per kg of two orchards in the same regions quickly identify the most efficient and effective management practises that can then be utilised across all orchards. In this way igrow provides a valuable tool for continuous improvement of orchard efficiency.

5. Conclusions

The igrow Orchard Management System provides an exciting new tool for growers to use in managing, and continuously improving the operations of their orchards. It combines an integrated approach to the capture of orchard operational data, food safety records and orchard logistics with easy, intuitive use and interactive applications.

Igrow uses off-the-shelf software tools such as MS SQL Server, Adobe ColdFusion and Adobe Action Script 3 to provide the dependability, large capability and speed needed for such an application.

Igrow was designed to be a "next generation" in orchard management software and this has been achieved.

6. Recommendations

This project has successfully developed the base platform for the igrow Orchard Management System.

This is really just the start of a new era of interactivity and connectedness between orchard operations, input suppliers and customers.

While the project has achieved the aims set down in the proposal, further work will be needed to achieve the full potential of the system.