Dried Vine Fruit Irrigation Benchmarking 2002 - 2011

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Dried Vine Fruit Irrigation Benchmarking

Seasons 2002 - 2011

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Executive summary

The DPI Dried Vine Fruit Irrigation Benchmarking Project was initiated during the season 2001/02. It was established primarily as a tool for identifying “best irrigation management practices” with the goal of improving irrigators' performance and efficiency.

This annual report contains nine years of growers' data, from Victoria and New South Wales, covering seasons 2002/03 to 2010/11. Examples of the main information gathered for each site were the amount of water used, the variety, the irrigation system and scheduling method, the pumping and water costs, and the crop yields and gross returns per site.

The study continued to attract growers' interest, with an increasing number of participants and field sites since season 2002/03. In season 2010/11, the number of growers and sites reached 31 and 82 respectively. The total area for the sites studied covered 183 ha, which is almost twice the total area in season 2002/03. The grape varieties planted at the different sites were Carina, Gordo, Sultana, Sunmuscat, Waltham Cross and Zante Currant. It should be noted that this may not be a representative sample of growers and care must be adopted when attempting to extrapolate the results to the broader irrigation community.

Season 2010/11 was a bad year in terms of yield for many growers, e.g. 84% of sites had an average yield reduction of 52% compared to 2010. This was mostly as a result of the favourable conditions for diseases and loss in fruit quality associated with the above normal rainfall events during summer 2010/11. The maximum yield in 2011 was only 6.5 t/ha, while 75% of sites had yields lower than 3.8 t/ha. The median yield in 2011 (2.8 t/ha) was furthermore the lowest result over the nine-year period studied.

In terms of average yield per irrigation system type, the averages for drip (3.3 t/ha), furrow (2.2 t/ha), low level (2.4 t/ha) and overhead (3.5 t/ha) irrigated sites in season 2010/11 were respectively 58%, 49%, 42% and 61% of their corresponding individual nine-year average.

The higher effective rainfall during summer 2010/11 considerably reduced the need for supplementary irrigation. As expected, the irrigation water applied at most sites in 2011 was much lower than in the previous years. Compared to the previous irrigation season, the sites used on average between 3.0 ML/ha (drip) and 5.5 ML/ha (overhead) less water. The average water applied at drip irrigated sites in 2010/11 also continued to be lower than the averages at sites with other irrigation systems.

Throughout the nine-year period, sites using the tensiometer method applied on average the least amount of water, i.e. 5.3 ML/ha, while an average of 6.2 ML/ha was used at sites using capacitance probes.

The irrigation application efficiency results showed there were a higher percentage of sites deemed under-irrigating in 2010/11, i.e. with application efficiency above 90%. That could either be a result of the overestimation of effective rainfall following rainfall events, or else due to the deliberate irrigation reduction at sites that were expecting low yields after diseases and crop damage.

It is important to note that irrigation application efficiency is a useful performance indicator only when it is used in conjunction with other performance indicators such as yield and water applied. The results in 2011 illustrated that point when some sites had high application efficiencies but with zero yields and low water applications.

Over the nine-year period, drip irrigation was the most reliable system to achieve application efficiencies within the recommended 85-90% range.

The results of crop production per water applied at most sites were generally higher in 2011 compared to 2010. In most cases, the higher values were the result of the yields obtained with much less applied irrigation.

A variety comparison showed Gordo had once again the highest seasonal average gross return per megalitre of water applied ($3590/ML in 2010/11). Conversely, Currant ($860/ML) continued to be the lowest performing variety.

In terms of gross return per dollar water input, the low irrigation applied and low water usage costs in 2011 resulted in higher returns at sites not significantly affected by diseases and yield reductions.

The gross return and cost performance indicators should be treated only as technical information, as they are determined using a partial system approach. A sound economic analysis is beyond the scope of the present study, since it would involve a whole system approach and more complex analysis, e.g. to perform marginal analysis.

1 Introduction

1.1 Background

The irrigation benchmarking study was initiated during the season 2001/02 in the dried vine fruit industry and was established primarily as a tool for monitoring growers' irrigation performances. It contributes to the partnership project “Benchmarking for Irrigated Table Grapes, Dried Vine Fruit, Almonds, Open Hydroponics and Centre Pivot Irrigated Potatoes” between the Department of Primary Industries (DPI) and the Mallee Catchment Management Authority (MCMA). This annual report contains nine years of data covering seasons 2002/03 to 2010/11.

1.2 Irrigation benchmarking

The DPI Dried Vine Fruit Irrigation Benchmarking Project aims to identify “best irrigation management practices” in the dried vine fruit industry with the goal of improving performance and efficiency. It is an expansion of previous successful benchmarking studies undertaken in the Mallee for wine grapes, citrus, potatoes, table grapes and almonds.

The project has evolved as a result of interest shown by growers, extension officers and policy makers in supporting improvement of irrigation management and water use efficiency.

Information collected during the benchmarking study includes:

- The amount of water used per site and variety
- Irrigation scheduling methods used
- Irrigation systems used
- Pumping and water costs
- Yields and returns

1.3 Report style

The report style adopted since 2009 ensures a consistent and effective mode of communication and is compliant with the Victorian Government Branding Policy and the new DPI visual style guide.

The report uses bar charts to display, in the body of the report and for each site, the last three years of the most important performance indicators as identified by the participants, i.e. crop yield, water applied, irrigation application efficiency and crop production per megalitre of water applied. The performances of all sites are presented in the same table but grouped by irrigation system and sorted within each variety sub-group, i.e. "Sultana" and "other varieties".

As all other performance indicators are deemed to be of value, and to allow for trend analysis, all indices for the nine years are included in Appendix C.

2 Method

2.1 Data collection

Dried vine fruit growers from Victoria and New South Wales completed questionnaires on their irrigation practices for the irrigation seasons 2002/03 to 2010/11. The data collected included irrigation system and pump details, crop varieties, vine spacing, area of the site, age of vines, soil types, irrigation scheduling methods used and yields. The questions were aimed at developing a better understanding of each grower's current level of irrigation performance. Weather data was also entered to match site locations and water costs were calculated using information provided by the participants and by the water authorities.

The study continued to attract growers' interest, with an increasing number of participants and field sites since season 2002/03 (Table 1). In 2010/11, the number of growers and sites grew to 31 and 82 respectively. The total area for the sites studied covered 183 ha, which is almost twice the total area in 2002/03. However, it should be noted that this is only a small sample and care must be adopted when attempting to extrapolate any results to the broader irrigation community.

Table1: Number of participating growers, field sites and total area per season

Season	Number of growers	Number of sites	Area (ha)
2002/03	22	42	95
2003/04	23	47	105
2004/05	24	58	134
2005/06	23	56	126
2006/07	29	70	152
2007/08	26	63	131
2008/09	27	67	134
2009/10	30	74	148
2010/11	31	82	183

The irrigation systems used included low level sprinklers, overhead sprinklers, drip and furrow irrigation. The grape varieties planted at the different sites were Carina, Gordo, Sultana, Sunmuscat, Waltham Cross and Zante Currant.

2.2 Indicators of irrigation performance

The data collected were analysed using the "Irrigation Benchmarking Module", database software developed by the South Australia Irrigated Crop Management Service, Primary Industries and Resources South Australia (PIRSA). A data consistency check of the database and processed data was performed at the end of each crop season.

Performance indicators were defined using the format from previous studies (Skewes and Meissner, 1997). The results from each site were compared and ranked. These allow growers to compare their own irrigation management practices with others from season to season.

Yield, which is the traditional measure for vineyard performance and is represented in tonnes per hectare (t/ha), and several other performance indicators were used to compare every site (details of all performance indicators can be viewed in Appendix C). The main indices used were:

- Yield
- Irrigation water applied
- Irrigation application efficiency
- Crop production per megalitre of water applied
- Gross return per megalitre of water applied
- Cost of water per tonne of fruit
- Gross return per dollar of water input

The gross return and cost performance indicators should be treated only as technical information, as they are determined using a partial system approach. A sound economic analysis is beyond the scope of the present study, since it would involve a whole system approach and more complex analysis, e.g. to perform marginal analysis.

Furthermore an evaluation study (Pollock, 2009), which had as its objective to review and improve the usability of the graphical data and other information in the annual report, produced the following main recommendations:

- The use of bar charts in the body of the report to display the last three years' results of the following performance indicators:
  - Yield
  - Irrigation water applied
  - Irrigation application efficiency
  - Crop production per megalitre of water applied
- The use of tables and box plots to show performance indicators in the body of the report
- The display, for each site, of all performance indicators for all seasons in Appendix C

An efficient irrigator is defined in this report as one who applies the correct amount of water at the right time to meet the crop water requirement. It is generally recommended to apply no more than 115% of the root zone soil moisture deficit, i.e. to use only 10-15% of the irrigation water for leaching any harmful salts from the root zone.

The present study focuses solely on irrigation management practices and not on other aspects that could be affecting crop production. For example, soil water holding capacity, crop load, canopy size, crop and emitter spacing, fertiliser and herbicide application practices, soil types and variation in environmental conditions are not discussed in this report.

Irrigation benchmarking is also best viewed over a number of years to derive more interpretable results and to minimise inevitable seasonal variation. Such variation can be seen in cyclical pricing that can influence gross returns in any particular year. The results should not be interpreted as being definitive since this report was compiled from data covering a limited time span and a small sample of industry growers who operate in a district of great diversity.

2.3 Site locations

Growers were located in Dareton, Irymple, Merbein, Mildura, Pomona, Red Cliffs, Swan Hill and Wentworth as indicated on the map depicted in Figure 1.

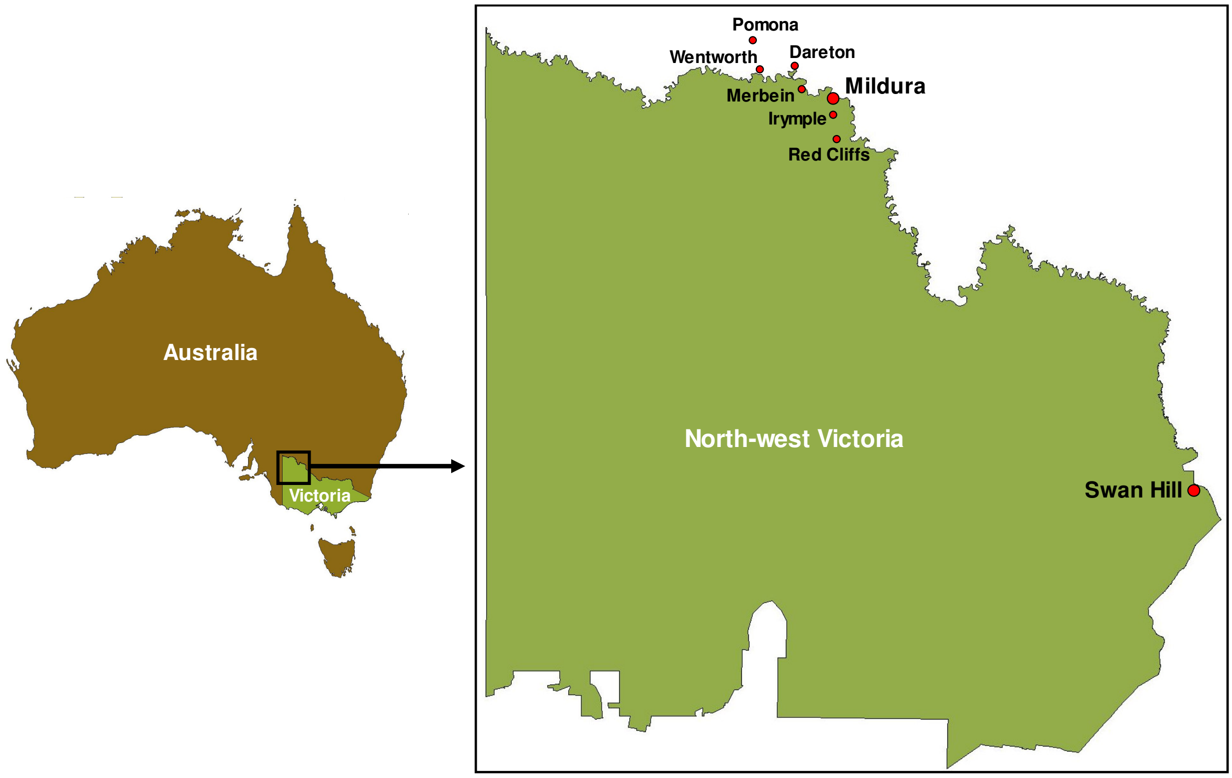


Figure 1: Site locations included in study

3 Results

3.1 Yield and irrigation water applied

The yield and irrigation water applied at all sites for each season are shown as box plots in Figures 2 and 3 respectively. The lower and upper ends of the coloured box indicate the 25th and 75th percentiles respectively while the inside band indicates the median (50th percentile). In other words, these percentiles respectively indicate the level below which 25%, 75% and 50% of the sites fall. Conversely, the same percentiles can also be interpreted as the level above which 75%, 25% and 50% of the sites are located. The ends at the vertical broken lines indicate the range of observed values while single dots represent outliers (see Appendix D for an example of how to interpret box plots).

Season 2010/11 was a bad year in terms of yield for many growers. The rainfall events during summer caused favourable conditions for diseases and loss in fruit quality. The median yield in 2011 (2.8 t/ha) was the lowest result over the period studied, e.g. 1.2 t/ha less than the second lowest median (4.0 t/ha in 2010) and 4.7 t/ha less than the highest median (7.5 t/ha in 2004). Furthermore, while the maximum yield in 2011 was 6.5 t/ha, 75% of sites had yields lower than 3.8 t/ha.

Figure 3 clearly shows the irrigation water applied at most sites in 2011 was considerably lower than in the previous years. This was mainly the result of the above normal rainfall events, during summer in season 2010/11, which satisfied most of the peak crop water demand and reduced the need for supplementary irrigation.

The median water applied in 2011 (2.5 ML/ha) was 3.6 ML/ha lower compared to the 6.1 ML/ha in 2010, and 3.2 ML/ha less than the second lowest median (5.7 ML/ha in 2003). The water applied at sites in 2011 varied between 0.4 ML/ha and 5.1 ML/ha, with 75% of sites applying less than 3.2 ML/ha.

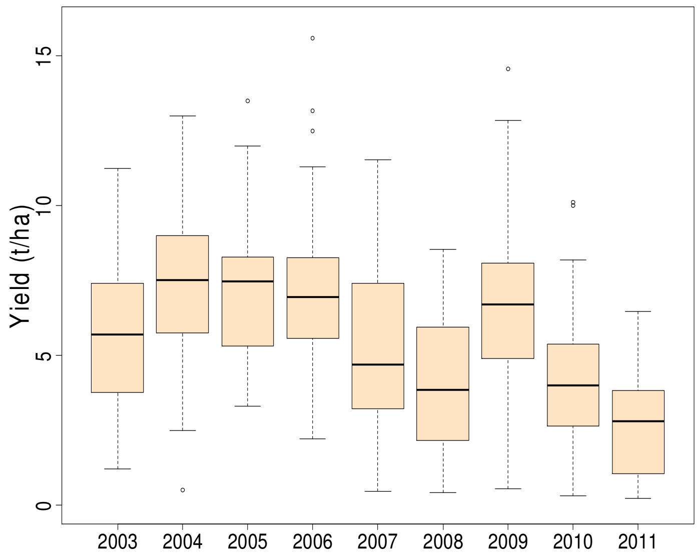


Figure 2: Box plot of yield between 2003 and 2011

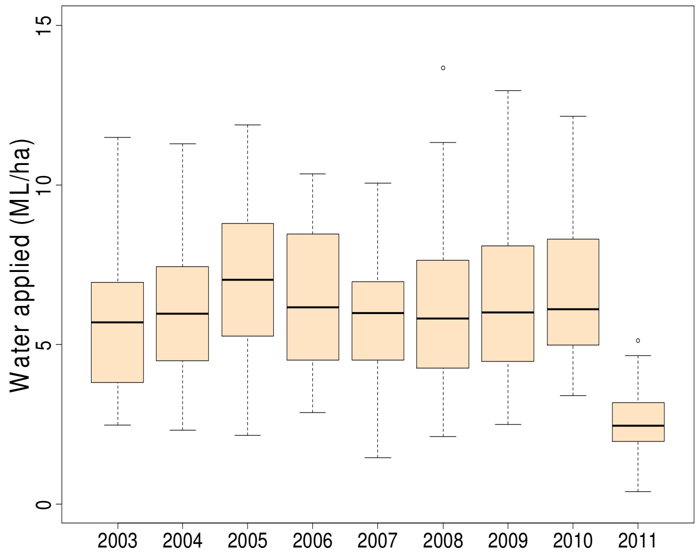


Figure 3: Box plot of water applied between 2003 and 2011

3.1.1 Yield and water applied per irrigation system types

Table 2 presents the average water applied and average yield per irrigation system type over the nine crop seasons. In 2010/11, the number of overhead, drip and low level irrigated sites increased by five, four and one respectively, while the number of furrow irrigated sites decreased by two. The majority of sites in 2010/11 were using drip, furrow and low level irrigation, i.e. 25, 23 and 25 respectively, compared to only 9 sites for overhead irrigation.

The average water applied at drip irrigated sites in 2010/11 continued to be lower than the averages at sites with other irrigation systems, e.g. 2.2 ML/ha (drip), 2.3 ML/ha (furrow), 3.4 ML/ha (low level) and 2.3 ML/ha (overhead). The average water applied by each system in 2010/11 was also the lowest so far and less than half the corresponding nine-year average. Compared to 2009/10, in 2010/11 the sites used on average between 3.0 ML/ha (drip) and 5.5 ML/ha (overhead) less water.

Table 2: Number of sites, average seasonal amount of water applied and yield - Irrigation system type comparison

	Season	Drip	Furrow	Low level	Overhead
	2002/03	16	5	14	7
	2003/04	18	7	14	8
Number of sites	2004/05	19	11	20	8
	2005/06	18	10	20	8
	2006/07	16	23	22	9
	2007/08	19	19	18	7
	2008/09	22	20	21	4
	2009/10	21	25	24	4
	2010/11	25	23	25	9
	Total	**174**	**143**	**178**	**64**
	2002/03	6.2	8.4	6.0	6.0
Average water applied (ML/ha)	2003/04	6.2	7.6	6.5	7.2
	2004/05	6.8	7.5	7.5	7.0
	2005/06	6.3	6.6	7.0	6.0
	2006/07	5.6	6.1	5.7	6.5
	2007/08	5.4	6.5	7.3	6.8
	2008/09	5.3	6.7	8.4	6.2
	2009/10	5.2	6.5	7.8	7.8
	2010/11	2.2	2.3	3.4	2.3
	Average	**5.3**	**6.5**	**6.6**	**6.0**
	2002/03	5.5	5.0	6.1	4.2
Average yield (t/ha)	2003/04	7.4	5.9	8.6	6.4
	2004/05	6.6	6.0	8.0	8.0
	2005/06	6.3	8.4	6.8	7.8
	2006/07	6.1	4.8	5.3	5.2
	2007/08	4.5	3.8	3.6	4.7
	2008/09	7.7	5.2	7.1	6.2
	2009/10	4.4	3.0	5.4	3.7
	2010/11	3.3	2.2	2.4	3.5
	Average	**5.7**	**4.5**	**5.7**	**5.7**

Similarly to the water applied, the yields in 2010/11 were the lowest results since 2002/03. In 2010/11, low level irrigated sites had an average yield (2.4 t/ha) that was only 42% of its nine-year average (5.7 t/ha). For drip, furrow and overhead irrigated sites, their averages were respectively 58%, 49% and 61% of their corresponding individual overall average.

Compared to the previous season, the maximum decrease in yield in 2010/11 was 3.0 t/ha for low level irrigated sites, while for other irrigation systems the reduction in yield were 1.1 t/ha (drip), 0.8 t/ha (furrow) and 0.2 t/ha (overhead).

The highest yield averages were achieved with overhead irrigation (3.5 t/ha) and drip irrigation (3.3 t/ha). Yields at sites with low level (2.4 t/ha) and furrow (2.2 t/ha) irrigation systems were on average 33% lower than at sites with drip or overhead irrigation systems.

For the period studied, furrow irrigated sites had a lower nine-year average (4.5 t/ha) compared to sites with other irrigation systems, i.e. 5.7 t/ha.

The box plots in Figures 4 and 5 show respectively the variation of yield and water applied between the different sites and irrigation systems in 2009, 2010 and 2011.

The yields in 2011 for the different irrigation system types were generally lower compared to 2009 and 2010 (Figure 4). In 2011, 50% of sites had yields below 3.2 t/ha (drip), 2.3 t/ha (furrow), 2.5 t/ha (low level) and 3.0 t/ha (overhead).

Figure 5 confirms the water applied at most sites within each irrigation system was considerably lower in 2011. The medians for furrow, overhead, low level and drip irrigated sites in 2011 were 2.3 ML/ha, 2.3 ML/ha, 3.7 ML/ha and 2.2 ML/ha respectively, representing less than half the medians in 2010, e.g. 5.6 ML/ha (furrow), 7.4 ML/ha (overhead), 6.9 ML/ha (Low level) and 5.3 ML/ha (drip).

Figures 6a and 6b and Tables 3a and 3b present the performance of each site, in terms of yield and ranking, for the years 2011, 2010 and 2009. To improve the quality of the graphs and tables for the number of sites involved, the results were grouped by irrigation system type and split into two pages. The sites were further regrouped in two variety categories, i.e. Sultana and non-Sultana varieties, and ranked according to the highest overall yield in each year.

The individual results show 84% of sites had a yield reduction in 2011. The average yield at those sites was 52% less compared to 2010. Conversely, for sites that achieved higher yields in 2011, their average yield increase was 73%.

Among the top ten sites in 2011, there were seven drip, two low level and one furrow irrigated sites. In terms of varieties grown by these top ten sites, there were four sites with Sunmuscat, three with Carina, two with Sultana and one with Gordo.

The results in 2011 again show wide variations in yield between sites within each irrigation system and variety group, e.g. from 0.5 t/ha to 5.8 t/ha for sites using drip irrigation and growing Sultana, or from 0.2 t/ha to 4.6 t/ha for sites using furrow irrigation and growing varieties other than Sultana. The results confirm high yields do not depend only on the combination of a specific irrigation system and variety, but also depend on other factors, e.g. irrigation and crop management best practices among others.

The water applied at different sites is presented in Figures 7a and 7b and Tables 4a and 4b. The sites were grouped and listed in the same order as the yields, presented in Figures 6a and 6b and Tables 3a and 3b, to facilitate comparison of yield and water applied. However, the ranks in Tables 4a and 4b were based on the lowest water applied in each year.

The results show all sites used less water in 2011 compared to 2010. The water reduction between the two years ranged between 26% and 94% for an average of 58%. In terms of minimum water usage, there were seven furrow irrigated sites in the top rankings but unfortunately five of them did not achieve any yield in 2011.

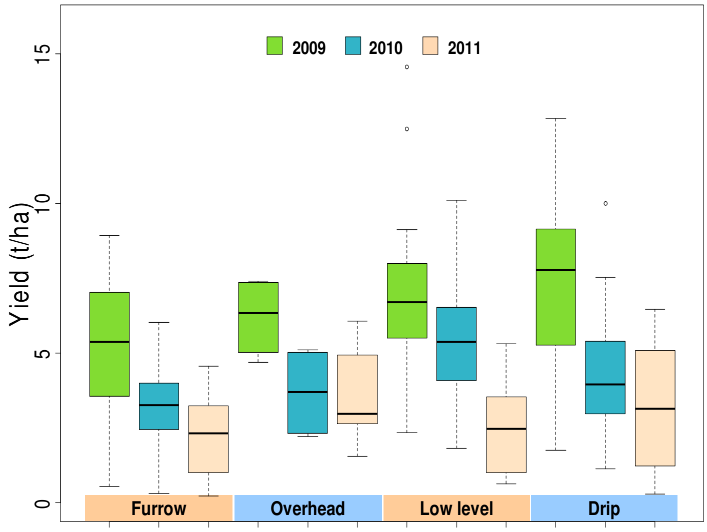


Figure 4: Box plot of yield per irrigation system type for 2009, 2010 and 2011

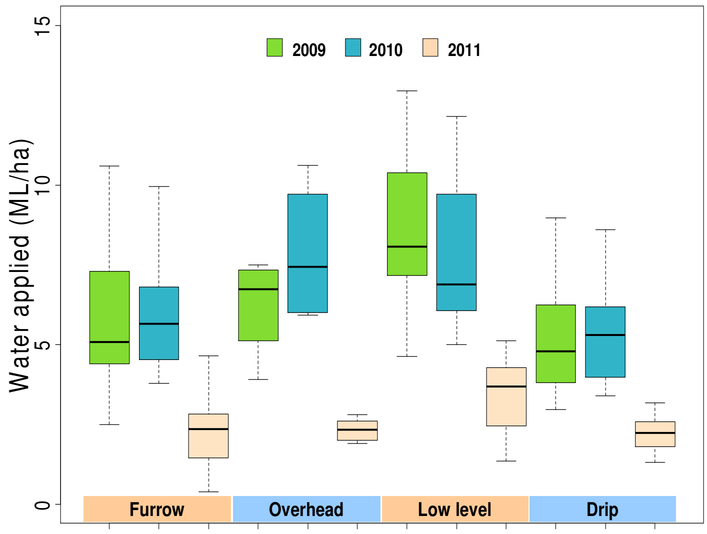
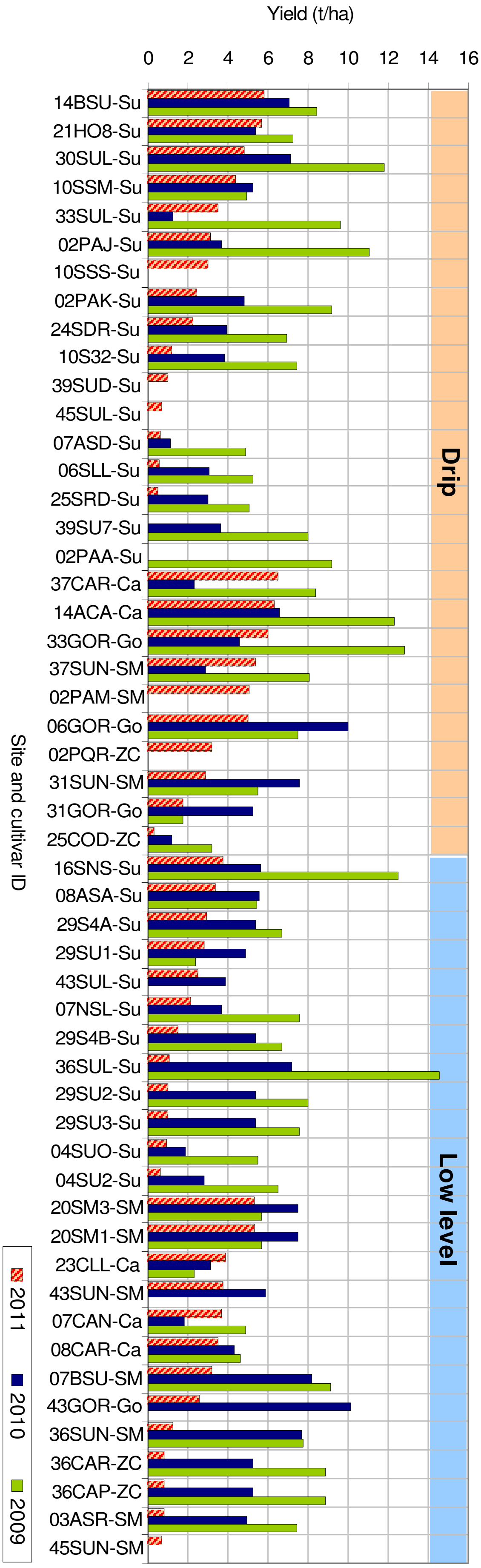


Figure 5: Box plot of water applied per irrigation system type for 2009, 2010 and 2011

Figure 6a: Yield at sites using drip or low level irrigation



Ca: Carina, Go: Gordo, Su: Sultana, SM: Sunmuscat, Wa: Waltham, ZC: Zante currant

Table 3a: Sites using drip or low level irrigation ranked with respect to the highest yield

	Yield						
	(t/ha)			Rank*			
Site	2011	2010	2009	2011	2010	2009	
14BSU-Su	5.8	7.0	8.4	**5**	**10**	15	Drip
21HO8-Su	5.7	5.4	7.2	**6**	17	31	Drip
30SUL-Su	4.8	7.1	11.8	13	**9**	**5**	Drip
10SSM-Su	4.4	5.3	4.9	15	23	49	Drip
33SUL-Su	3.5	1.2	9.6	24	67	**7**	Drip
02PAJ-Su	3.1	3.7	11.0	29	42	**6**	Drip
10SSS-Su	3.0			30			Drip
02PAK-Su	2.4	4.8	9.2	41	31	**8**	Drip
24SDR-Su	2.2	4.0	7.0	43	39	32	Drip
10S32-Su	1.2	3.8	7.4	50	41	27	Drip
39SUD-Su	1.0			54			Drip
45SUL-Su	0.7			64			Drip
07ASD-Su	0.6	1.1	4.9	66	70	50	Drip
06SLL-Su	0.6	3.1	5.3	67	51	47	Drip
25SRD-Su	0.5	3.0	5.1	68	52	48	Drip
39SU7-Su		3.6	8.0		44	18	Drip
02PAA-Su			9.2			**8**	Drip
37CAR-Ca	6.5	2.3	8.4	**1**	62	16	Drip
14ACA-Ca	6.3	6.6	12.3	**2**	11	**4**	Drip
33GOR-Go	6.0	4.6	12.8	**4**	32	**2**	Drip
37SUN-SM	5.4	2.9	8.1	**7**	54	17	Drip
02PAM-SM	5.1			**10**			Drip
06GOR-Go	5.0	10.0	7.5	11	**2**	25	Drip
02PQR-ZC	3.2			27			Drip
31SUN-SM	2.9	7.5	5.5	32	**5**	43	Drip
31GOR-Go	1.8	5.3	1.7	45	22	65	Drip
25COD-ZC	0.3	1.2	3.2	70	68	59	Drip
16SNS-Su	3.8	5.6	12.5	20	15	**3**	Low level
08ASA-Su	3.4	5.6	5.5	25	16	44	Low level
29S4A-Su	2.9	5.4	6.7	31	18	33	Low level
29SU1-Su	2.8	4.9	2.4	33	30	63	Low level
43SUL-Su	2.5	3.9		40	40		Low level
07NSL-Su	2.1	3.7	7.6	44	43	23	Low level
29S4B-Su	1.5	5.4	6.7	47	18	33	Low level
36SUL-Su	1.1	7.2	14.6	53	**8**	**1**	Low level
29SU2-Su	1.0	5.4	8.0	55	18	20	Low level
29SU3-Su	1.0	5.4	7.6	55	18	24	Low level
04SUO-Su	1.0	1.9	5.5	57	65	42	Low level
04SU2-Su	0.6	2.8	6.5	65	55	36	Low level
20SM3-SM	5.3	7.5	5.7	**8**	**6**	39	Low level
20SM1-SM	5.3	7.5	5.7	**8**	**6**	39	Low level
23CLL-Ca	3.8	3.1	2.3	18	50	64	Low level
43SUN-SM	3.8	5.9		19	13		Low level
07CAN-Ca	3.7	1.8	4.9	21	66	51	Low level
08CAR-Ca	3.5	4.3	4.7	23	35	53	Low level
07BSU-SM	3.2	8.2	9.1	26	**3**	**10**	Low level
43GOR-Go	2.5	10.1		39	**1**		Low level
36SUN-SM	1.2	7.7	7.8	49	**4**	22	Low level
36CAR-ZC	0.8	5.3	8.9	58	24	12	Low level
36CAP-ZC	0.8	5.3	8.9	58	24	12	Low level
03ASR-SM	0.8	4.9	7.4	60	28	27	Low level
45SUN-SM	0.7			63			Low level

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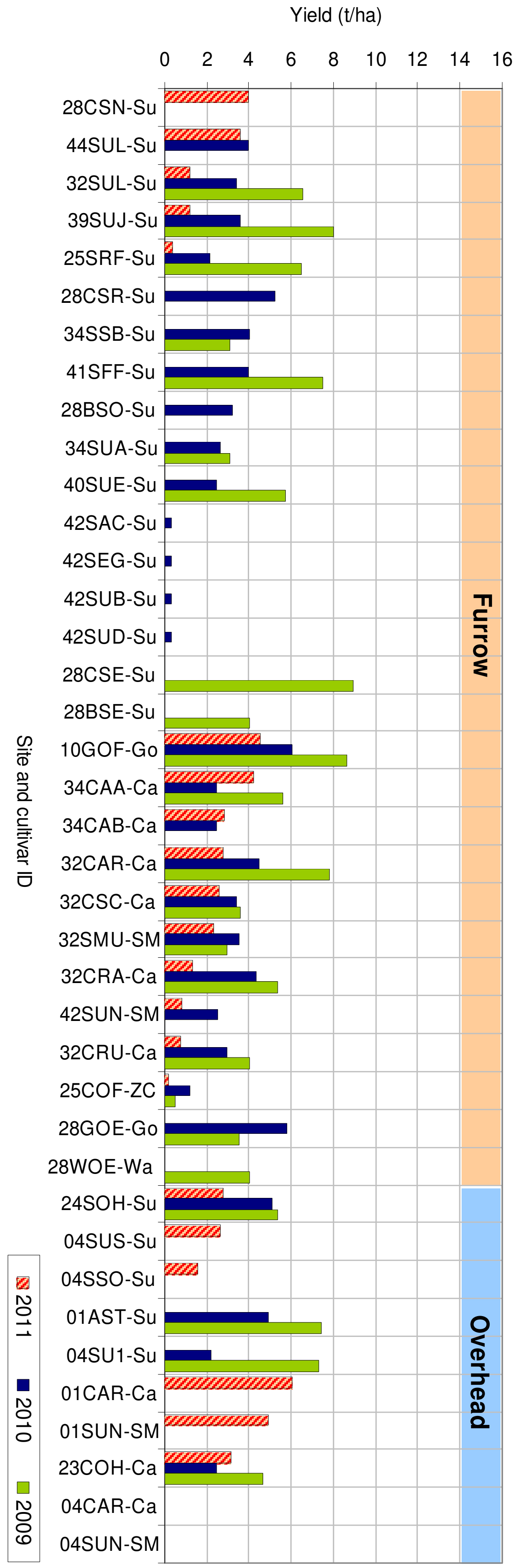
* Based on all sites, i.e. with drip, low level, furrow and overhead irrigation

Figure 6b: Yield at sites using furrow or overhead irrigation



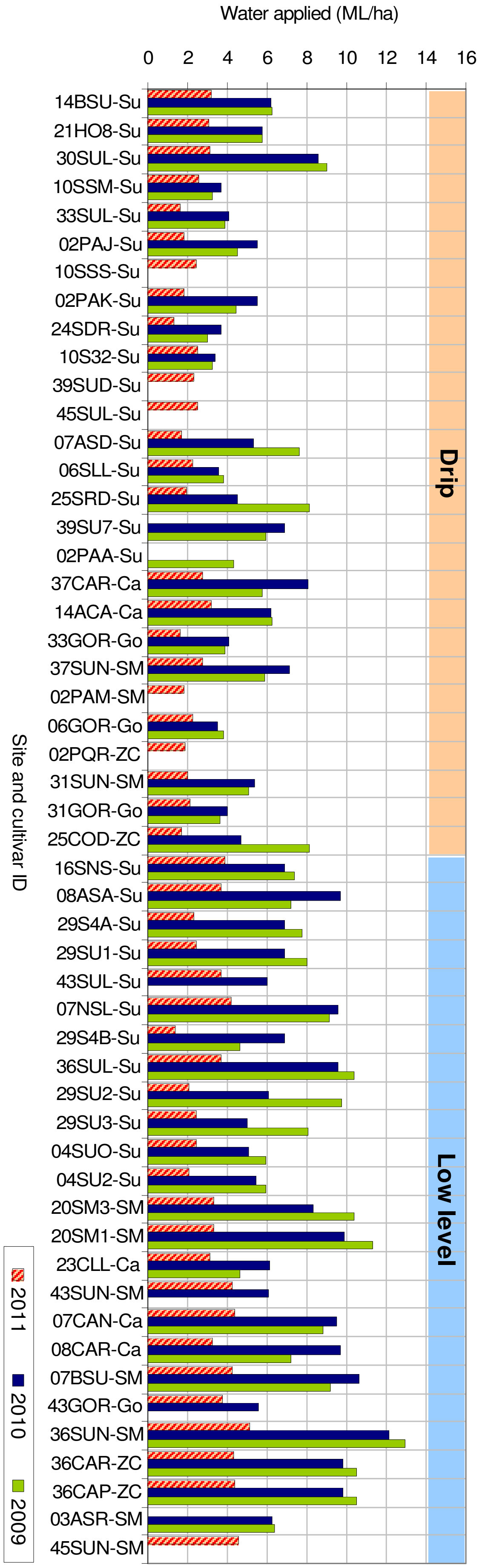
Ca: Carina, Go: Gordo, Su: Sultana, SM: Sunmuscat, Wa: Waltham, ZC: Zante currant

Table 3b: Sites using furrow or overhead irrigation ranked with respect to the highest yield

	Yield (t/ha)			Rank*			
Site	2011	2010	2009	2011	2010	2009	
28CSN-Su	4.0			17			Furrow
44SUL-Su	3.6	4.0		22	38		
32SUL-Su	1.2	3.4	6.6	51	47	35	
39SUJ-Su	1.2	3.6	8.0	52	44	18	
25SRF-Su	0.4	2.2	6.5	69	64	37	
28CSR-Su		5.2			26		
34SSB-Su		4.0	3.1		36	60	
41SFF-Su		4.0	7.5		37	25	
28BSO-Su		3.2			49		
34SUA-Su		2.6	3.1		56	60	
40SUE-Su		2.4	5.8		58	38	
42SAC-Su		0.3			71		
42SEG-Su		0.3			71		
42SUB-Su		0.3			71		
42SUD-Su		0.3			71		
28CSE-Su			8.9			11	
28BSE-Su			4.0			55	
10GOF-Go	4.6	6.0	8.6	14	12	14	
34CAA-Ca	4.2	2.4	5.6	16	59	41	
34CAB-Ca	2.8	2.4		33	59		
32CAR-Ca	2.8	4.5	7.8	35	33	21	
32CSC-Ca	2.6	3.4	3.6	38	48	57	
32SMU-SM	2.3	3.5	3.0	42	46	62	
32CRA-Ca	1.3	4.3	5.4	48	34	45	
42SUN-SM	0.8	2.5		61	57		
32CRU-Ca	0.8	3.0	4.1	62	52	54	
25COF-ZC	0.2	1.2	0.5	71	69	66	
28GOE-Go		5.8	3.5		14	58	
28WOE-Wa			4.0			55	
24SOH-Su	2.8	5.1	5.4	35	27	46	Overhead
04SUS-Su	2.6			37			
04SSO-Su	1.6			46			
01AST-Su		4.9	7.4		28	27	
04SU1-Su		2.2	7.3		63	30	
01CAR-Ca	6.1			3			
01SUN-SM	4.9			12			
23COH-Ca	3.2	2.4	4.7	28	59	52	
04CAR-Ca							
04SUN-SM							
Maximum	6.5	10.1	14.6	71	74	66	
Median	2.8	4.0	6.7				
Minimum	0.2	0.3	0.5				

* Based on all sites, i.e. with drip, low level, furrow and overhead irrigation

Figure 7a: Water applied at sites using drip or low level irrigation



Ca: Carina, Go: Gordo, Su: Sultana, SM: Sunmuscat, Wa: Waltham, ZC: Zante currant

Table 4a: Sites using drip or low level irrigation ranked with respect to the lowest water applied

	Water applied (ML/ha)			Rank*			
Site	2011	2010	2009	2011	2010	2009	
14BSU-Su	3.2	6.2	6.3	61	40	35	Drip
21HO8-Su	3.1	5.8	5.8	57	32	28	Drip
30SUL-Su	3.1	8.6	9.0	59	57	57	Drip
10SSM-Su	2.6	3.7	3.3	45	**4**	**3**	Drip
33SUL-Su	1.7	4.1	3.9	**10**	12	**9**	Drip
02PAJ-Su	1.8	5.5	4.5	14	28	21	Drip
10SSS-Su	2.4			37			Drip
02PAK-Su	1.8	5.5	4.5	14	28	17	Drip
24SDR-Su	1.3	3.7	3.0	**7**	**5**	**2**	Drip
10S32-Su	2.5	3.4	3.3	44	**1**	**4**	Drip
39SUD-Su	2.3			33			Drip
45SUL-Su	2.5			42			Drip
07ASD-Su	1.7	5.3	7.6	12	23	46	Drip
06SLL-Su	2.2	3.6	3.8	31	**3**	**7**	Drip
25SRD-Su	1.9	4.5	8.1	20	15	51	Drip
39SU7-Su		6.9	5.9		53	33	Drip
02PAA-Su			4.3			14	Drip
37CAR-Ca	2.8	8.1	5.8	49	55	29	Drip
14ACA-Ca	3.2	6.2	6.3	61	40	36	Drip
33GOR-Go	1.7	4.1	3.9	**10**	12	**9**	Drip
37SUN-SM	2.8	7.1	5.9	49	54	30	Drip
02PAM-SM	1.8			14			Drip
06GOR-Go	2.2	3.5	3.8	31	**2**	**7**	Drip
02PQR-ZC	1.9			17			Drip
31SUN-SM	2.0	5.4	5.1	24	26	25	Drip
31GOR-Go	2.1	4.0	3.6	29	11	**6**	Drip
25COD-ZC	1.7	4.7	8.1	13	17	51	Drip
16SNS-Su	3.9	6.9	7.4	72	49	44	Low level
08ASA-Su	3.7	9.7	7.2	69	66	42	Low level
29S4A-Su	2.3	6.9	7.8	33	50	47	Low level
29SU1-Su	2.4	6.9	8.0	39	50	49	Low level
43SUL-Su	3.7	6.0		68	34		Low level
07NSL-Su	4.2	9.6	9.2	73	64	58	Low level
29S4B-Su	1.4	6.9	4.6	**8**	50	22	Low level
36SUL-Su	3.7	9.6	10.4	70	64	61	Low level
29SU2-Su	2.1	6.1	9.7	26	37	60	Low level
29SU3-Su	2.4	5.0	8.1	37	21	50	Low level
04SUO-Su	2.5	5.1	5.9	41	22	31	Low level
04SU2-Su	2.0	5.4	5.9	25	27	31	Low level
20SM3-SM	3.3	8.3	10.4	65	56	62	Low level
20SM1-SM	3.3	9.9	11.3	65	70	66	Low level
23CLL-Ca	3.1	6.1	4.6	60	39	23	Low level
43SUN-SM	4.3	6.0		74	35		Low level
07CAN-Ca	4.4	9.5	8.8	77	63	56	Low level
08CAR-Ca	3.3	9.7	7.2	64	66	42	Low level
07BSU-SM	4.3	10.7	9.2	75	73	59	Low level
43GOR-Go	3.7	5.6		71	30		Low level
36SUN-SM	5.1	12.2	13.0	81	74	67	Low level
36CAR-ZC	4.3	9.8	10.5	76	68	63	Low level
36CAP-ZC	4.4	9.8	10.5	78	68	63	Low level
03ASR-SM		6.3	6.4		42	39	Low level
45SUN-SM	4.5			79			Low level

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* Based on all sites, i.e. with drip, low level, furrow and overhead irrigation

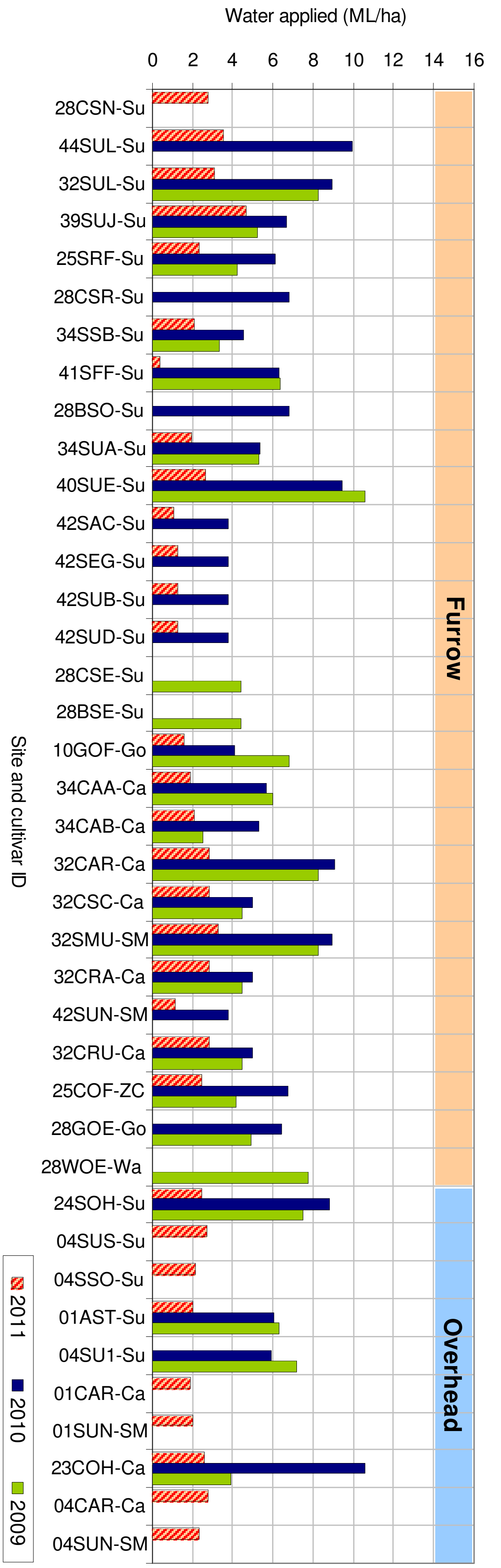


Figure 7b: Water applied at sites using furrow or overhead irrigation

Ca: Carina, Go: Gordo, Su: Sultana, SM: Sunmuscat, Wa: Waltham, ZC: Zante currant

Table 4b: Sites using furrow or overhead irrigation ranked with respect to the lowest water applied

	Water applied (ML/ha)			Rank*			
Site	2011	2010	2009	2011	2010	2009	
28CSN-Su	2.8			51			Furrow
44SUL-Su	3.5	10.0		67	71		Furrow
32SUL-Su	3.1	9.0	8.3	57	59	53	Furrow
39SUJ-Su	4.7	6.7	5.2	80	45	26	Furrow
25SRF-Su	2.3	6.1	4.2	36	38	13	Furrow
28CSR-Su		6.8			47		Furrow
34SSB-Su	2.1	4.5	3.4	27	16	**5**	Furrow
41SFF-Su	0.4	6.3	6.4	**1**	43	38	Furrow
28BSO-Su		6.8			47		Furrow
34SUA-Su	2.0	5.4	5.3	21	25	27	Furrow
40SUE-Su	2.6	9.4	10.6	47	62	65	Furrow
42SAC-Su	1.1	3.8		**2**	**6**		Furrow
42SEG-Su	1.3	3.8		**4**	**6**		Furrow
42SUB-Su	1.3	3.8		**5**	**6**		Furrow
42SUD-Su	1.3	3.8		**5**	**6**		Furrow
28CSE-Su			4.4			15	Furrow
28BSE-Su			4.4			15	Furrow
10GOF-Go	1.6	4.1	6.8	**9**	14	40	Furrow
34CAA-Ca	1.9	5.6	6.0	17	31	34	Furrow
34CAB-Ca	2.1	5.3	2.5	28	24	**1**	Furrow
32CAR-Ca	2.8	9.1	8.3	56	61	53	Furrow
32CSC-Ca	2.8	5.0	4.5	53	18	18	Furrow
32SMU-SM	3.3	9.0	8.3	63	59	53	Furrow
32CRA-Ca	2.8	5.0	4.5	53	18	18	Furrow
42SUN-SM	1.1	3.8		**3**	**6**		Furrow
32CRU-Ca	2.8	5.0	4.5	53	18	18	Furrow
25COF-ZC	2.4	6.7	4.2	39	46	12	Furrow
28GOE-Go		6.4	4.9		44	24	Furrow
28WOE-Wa			7.8			48	Furrow
24SOH-Su	2.5	8.8	7.5	42	58	45	Overhead
04SUS-Su	2.7			48			Overhead
04SSO-Su	2.1			29			Overhead
01AST-Su	2.0	6.1	6.3	22	36	37	Overhead
04SU1-Su		5.9	7.2		33	41	Overhead
01CAR-Ca	1.9			19			Overhead
01SUN-SM	2.0			22			Overhead
23COH-Ca	2.6	10.6	3.9	46	72	**9**	Overhead
04CAR-Ca	2.8			52			Overhead
04SUN-SM	2.3			35			Overhead
Maximum	5.1	12.2	13.0	81	74	67	
Median	2.5	6.1	6.0				
Minimum	0.4	3.4	2.5				

* Based on all sites, i.e. with drip, low level, furrow and overhead irrigation

3.1.2 Yield and water applied per irrigation scheduling method

The method used to schedule irrigation can play an important part in how effectively and efficiently water is applied. Some of the methods considered in the present study were evapotranspiration graphs, tensiometers, capacitance probes (EnviroSCAN, C probe), gypsum blocks and experience only (including digging).

The number of sites per irrigation scheduling method in Table 5 shows there were more sites using capacitance probes in 2010/11. In terms of water applied, the results for the different scheduling methods in 2010/11 were less than half their corresponding averages in 2009/10 or over the nine-year period. Scheduling methods based on evaporation and experience used respectively the most and least amounts of water in 2010/11, i.e. 3.0 ML/ha and 2.1 ML/ha respectively.

Irrespective of irrigation scheduling method, the seasonal average yields in 2010/11 were the lowest results over the period studied. The seasonal yields in 2010/11 were between 2.5 t/ha (tensiometer) and 2.8 t/ha (evaporation and experience) lower than the corresponding nine seasons' average. Otherwise in 2010/11, sites using capacitance probes and tensiometers had the highest average yields (3.2 t/ha) while those using experience only had the lowest average yield (2.1 t/ha).

Table 5: Number of sites, average seasonal amount of water applied and yield - Irrigation scheduling method comparison

	Season	Capacitance	Evaporation	Experience	Gypsum block	Tensiometer
	2002/03	10	3	15		13
	2003/04	12	5	15	3	12
Number	2004/05	14	12	17	3	12
of sites	2005/06	12	12	14	5	13
	2006/07	13	12	13	6	26
	2007/08	15	8	12	14	14
	2008/09	21	7	13	13	13
	2009/10	21	7	21	12	13
	2010/11	26	15	19	12	10
	Total					
	2002/03	5.0	6.1	8.4		5.4
Average	2003/04	6.3	5.4	8.1	6.5	5.7
water	2004/05	7.1	7.0	8.5	5.9	5.8
applied	2005/06	6.4	7.6	6.7	5.8	5.7
(ML/ha)	2006/07	6.5	5.7	6.0	7.1	5.4
	2007/08	7.3	6.0	6.2	6.6	5.5
	2008/09	7.7	6.8	6.5	6.0	6.0
	2009/10	7.5	6.8	5.8	6.8	6.4
	2010/11	2.8	3.0	2.1	2.5	2.5
	Average	**6.2**	**5.9**	**6.5**	**5.8**	**5.3**
	2002/03	6.0	5.8	5.5		5.0
Average	2003/04	8.6	7.0	6.7	6.9	7.2
yield	2004/05	8.0	7.4	6.0	6.5	7.7
(t/ha)	2005/06	6.9	7.4	6.2	7.3	7.8
	2006/07	5.9	4.1	5.5	6.0	5.4
	2007/08	4.8	3.3	3.8	4.3	3.7
	2008/09	7.4	7.9	4.6	6.6	6.9
	2009/10	5.0	4.9	3.1	3.8	4.8
	2010/11	3.2	2.5	2.1	2.3	3.2
	Average	**5.9**	**5.3**	**4.9**	**4.9**	**5.7**

The distribution of yields per irrigation scheduling method for the last three years shows the results in 2011 were lower compared to the previous two years (Figure 8). Furthermore in 2011, while the five irrigation scheduling methods had almost similar medians, sites achieving the highest yields were mostly using capacitance probes or tensiometers.

Figure 9 clearly shows the box plots of water applied were much lower in 2011. The variations of water applied between sites with the same scheduling method in 2011 were also less pronounced. A comparison of the different methods in the last season further indicates sites that applied the lowest amount of water were mostly using experience alone.

As mentioned in previous reports, the use of irrigation scheduling methods and soil moisture monitoring devices alone does not make an efficient irrigator. Devices improperly installed, used incorrectly or not maintained can reduce the effectiveness of irrigation events. Effective irrigation scheduling therefore depends to a large extent on the skill of each individual grower.

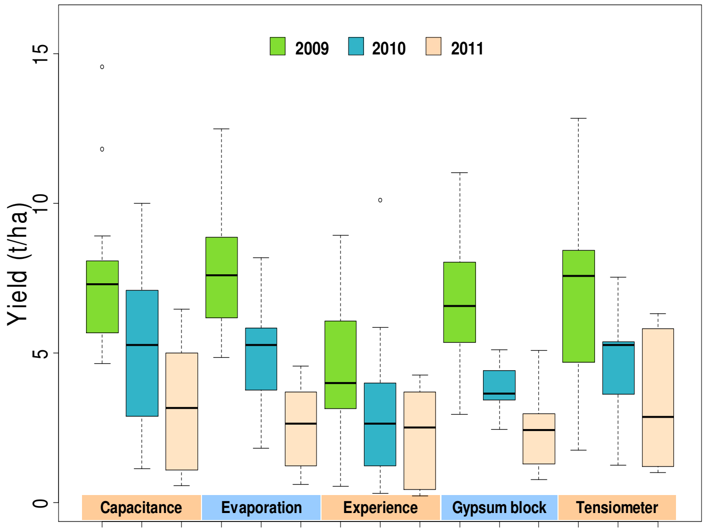


Figure 8: Box plot of yield per irrigation scheduling method for 2009, 2010 and 2011

3.2 Irrigation application efficiency

Application efficiency is calculated (see Equation 6 in Appendix B) for each site using the growers' irrigation records and weather data collected for the region where each property is located. In PIRSA's benchmarking module, the drainage calculation is based on the irrigation water applied in excess of the predicted daily crop water use. Daily crop water use depends on site specific weather data and a standard set of crop coefficients. The latter do not cater for differences in varieties, trellis orientation, canopy size, rootstocks, etc.

The results for this performance indicator should not be interpreted as being definitive due to the large number of variables that influence its calculation. However, application efficiency remains a valuable indicator of over or under irrigation, particularly at sites where crop coefficients are close to matching the generic standards, and is therefore a useful guide when comparing sites and properties for the purpose of irrigation benchmarking.

An application efficiency of 85-90%, as represented by the grey horizontal strip in Figure 10, would result in a leaching fraction of 10 - 15% of the total irrigation water applied and is considered optimal to prevent a build-up of harmful salts in the root zone. Conversely, application efficiencies below 85% indicate that an excessive amount of irrigation water is passing through the root zone, while application efficiencies greater than 90% indicate under-irrigation, i.e. not enough to satisfy the leaching requirements.

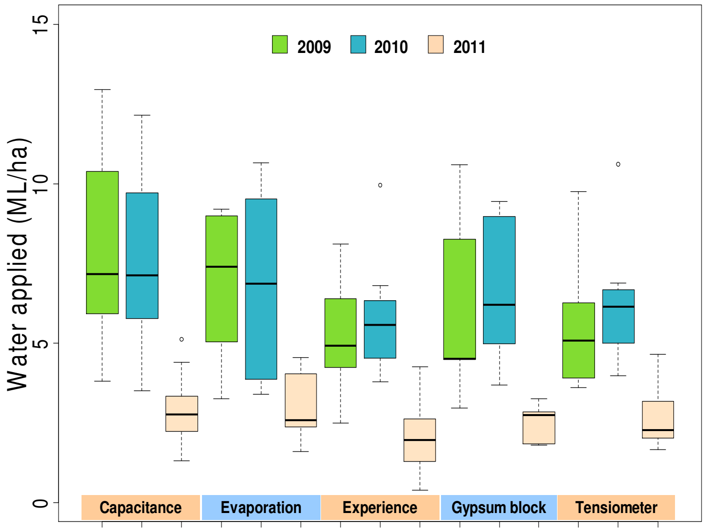


Figure 9: Box plot of water applied per irrigation scheduling method for 2009, 2010 and 2011

Table 6: Percentage of sites within, over and under the recommended 85-90% range of application efficiency

Season	Percentage of sites with application efficiency		
	within 85-90%	under 85-90%	over 85-90%
2002/03	23.8	47.6	28.6
2003/04	27.7	34.0	38.3
2004/05	6.9	60.3	32.8
2005/06	10.7	53.6	35.7
2006/07	14.3	65.7	20.0
2007/08	14.3	50.8	34.9
2008/09	9.0	65.7	25.4
2009/10	23.0	62.2	14.9
2010/11	18.3	22.0	58.5

Table 6 shows the percentages of sites achieving application efficiencies within, under and over the recommended 85-90% range. In 2010/11, the categories "under 85-90%" and "over 85-90%" had respectively their lowest (22.0%) and highest (58.5%) seasonal results of the nine seasons. The higher percentage of sites deemed under-irrigating in 2010/11, i.e. with application efficiency above 90%, could either be a result of the overestimation of effective rainfall following rainfall events, or else due to the deliberate irrigation reduction at sites that were expecting low yields after diseases and crop damage.

The box plot for 2011 (Figure 10) shows 50% of sites had an application efficiency greater than 92%. The results however also indicate the presence of a few outliers, represented by dots, with application efficiencies as low as 35%, i.e. 65% of the water applied was predicted to be lost through drainage. The median for 2011 (92%) was well above that of 2010 (82%) and also the highest median over the nine seasons.

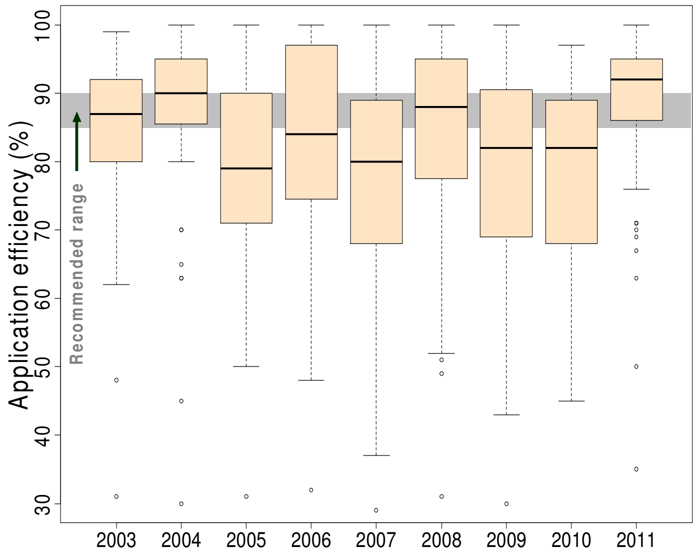


Figure 10: Box plot of irrigation application efficiency between 2003 and 2011

Table 7: Average application efficiency - Irrigation system type comparison

Season	Average gross return per dollar water input ($/$)			
	Drip	Furrow	Low level	Overhead
2002/03	25	12	21	11
2003/04	34	14	29	17
2004/05	27	13	19	22
2005/06	20	17	14	19
2006/07	49	16	17	30
2007/08	20	10	6	14
2008/09	26	13	11	13
2009/10	15	10	9	10
2010/11	47	17	17	43
Average	**29**	**14**	**15**	**21**

3.2.1 Application efficiency per irrigation system type

The nine-year averages in Table 7 confirm drip irrigation as the most reliable system to achieve application efficiencies within the recommended range. In 2010/11 however, the averages at sites using drip, furrow, low level and overhead irrigation were more or less equal, i.e. 90%, 88%, 87% and 89% respectively. Drip, low level and overhead irrigated sites also achieved their highest seasonal average application efficiency in the last season.

The box plots (Figure 11) show a clear increase in the application efficiencies at furrow, overhead and lower level irrigated sites in 2011. In the case of drip irrigated sites, where the previous years' results were already high, the obvious change was more in terms of a reduced variation between the application efficiencies at different sites. Furthermore in 2011, more than half of the furrow, overhead and drip irrigated sites had application efficiencies above the recommended 85-90% range, i.e. medians of 95% for furrow, 91% for overhead and 92% for drip irrigated sites.

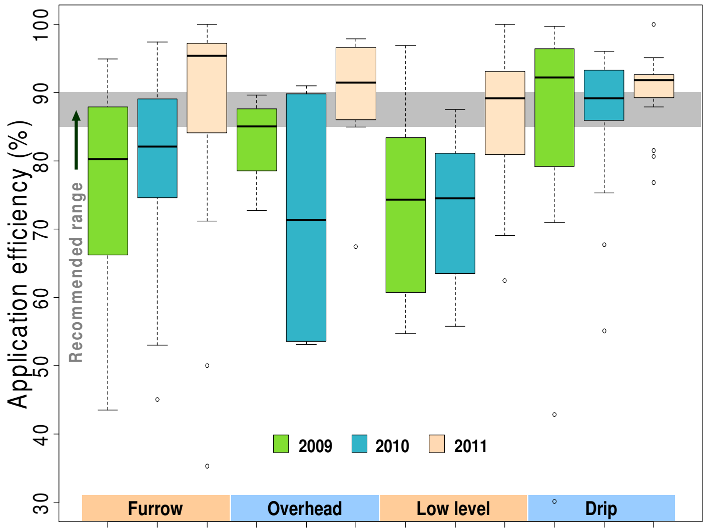


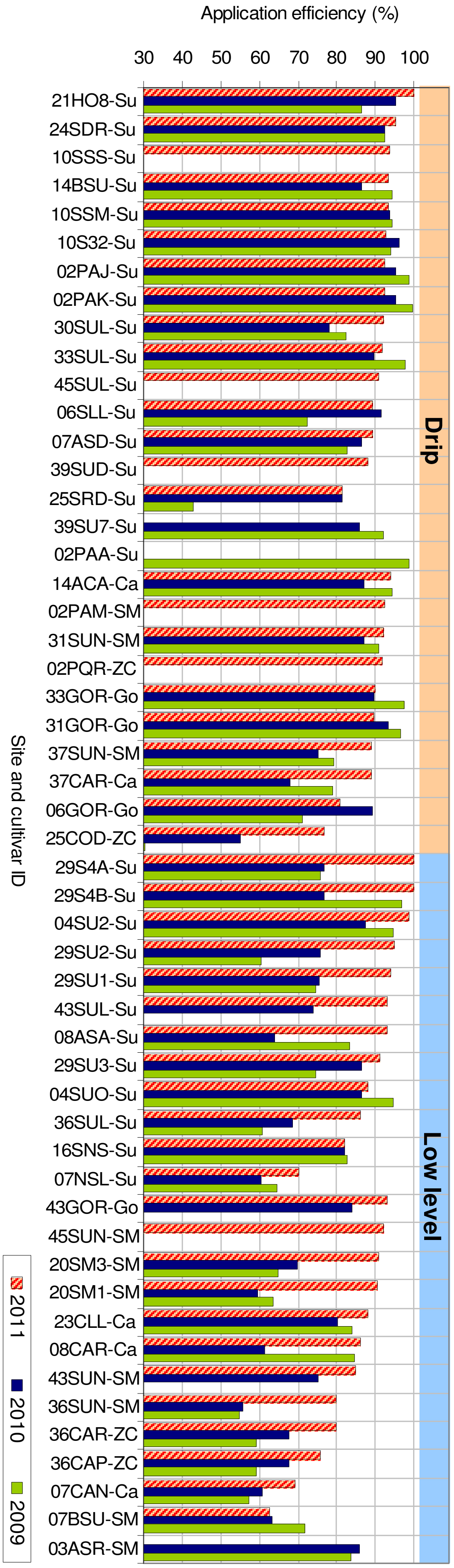
Figure 11: Box plot of irrigation application efficiency per irrigation system type for 2009, 2010 and 2011

Figures 12a and 12b compare the last three years' application efficiencies of sites, grouped by irrigation system type and variety. Tables 8a and 8b present the rank of each site with respect to the highest overall application efficiency in each year.

The tables show only one drip irrigated site in the top ten ranks in 2011, compared to seven and six in 2010 and 2009 respectively. The results also show the majority of sites have increased their application efficiency in 2011. While eight sites reached results as high as 100%, there were a few sites where the results were well below the recommended 85-90% range, e.g. 67%, 63%, 50% and 35%.

It is important to note that irrigation application efficiency is a useful performance indicator only when it is used in conjunction with other performance indicators such as yield and water applied. The results in 2011 illustrate this point when some sites had high application efficiencies but with zero yields and low water applications. For example, out of the eight furrow irrigated Sultana sites that had no yields (Table 3b) there were five sites with the lowest irrigation applied (Table 4b) but with application efficiencies higher than 85%.

Figure 12a: Application efficiency at sites using drip or low level irrigation



Ca: Carina, Go: Gordo, Su: Sultana, SM: Sunmuscat, Wa: Waltham, ZC: Zante currant

Table 8a: Sites using drip or low level irrigation ranked with respect to the highest application efficiency

	Application efficiency						
	(%)			Rank*			
Site	2011	2010	2009	2011	2010	2009	
21HO8-Su	100	95	87	8	3	24	Drip
24SDR-Su	95	92	92	20	8	15	Drip
10SSS-Su	94			27			Drip
14BSU-Su	93	86	94	28	28	12	Drip
10SSM-Su	93	94	94	29	6	11	Drip
10S32-Su	93	96	94	33	2	14	Drip
02PAJ-Su	92	95	99	34	4	2	Drip
02PAK-Su	92	95	100	34	4	1	Drip
30SUL-Su	92	78	82	39	43	34	Drip
33SUL-Su	92	90	98	41	14	4	Drip
45SUL-Su	91			45			Drip
06SLL-Su	89	91	72	51	10	48	Drip
07ASD-Su	89	86	83	51	29	32	Drip
39SUD-Su	88			55			Drip
25SRD-Su	81	81	43	66	40	66	Drip
39SU7-Su		86	92		30	16	Drip
02PAA-Su			99			3	Drip
14ACA-Ca	94	87	94	26	25	13	Drip
02PAM-SM	92			34			Drip
31SUN-SM	92	87	91	38	24	17	Drip
02PQR-ZC	92			40			Drip
33GOR-Go	90	90	97	49	15	5	Drip
31GOR-Go	90	93	96	50	7	7	Drip
37SUN-SM	89	75	79	53	49	39	Drip
37CAR-Ca	89	68	79	53	56	40	Drip
06GOR-Go	81	89	71	67	16	50	Drip
25COD-ZC	77	55	30	71	69	67	Drip
29S4A-Su	100	77	76	1	45	43	Low level
29S4B-Su	100	77	97	1	45	6	Low level
04SU2-Su	99	87	94	9	22	9	Low level
29SU2-Su	95	76	61	21	47	57	Low level
29SU1-Su	94	76	75	25	48	45	Low level
43SUL-Su	93	74		31	53		Low level
08ASA-Su	93	64	83	32	59	31	Low level
29SU3-Su	91	86	74	44	27	46	Low level
04SUO-Su	88	87	94	57	26	9	Low level
36SUL-Su	86	69	61	62	55	56	Low level
16SNS-Su	82	82	83	65	33	32	Low level
07NSL-Su	70	61	65	76	64	54	Low level
43GOR-Go	93	84		30	32		Low level
45SUN-SM	92			37			Low level
20SM3-SM	91	70	65	46	54	53	Low level
20SM1-SM	90	60	64	47	65	55	Low level
23CLL-Ca	88	80	84	56	42	29	Low level
08CAR-Ca	86	61	85	60	61	26	Low level
43SUN-SM	85	75		63	50		Low level
36SUN-SM	80	56	55	69	68	61	Low level
36CAR-ZC	80	68	59	70	58	58	Low level
36CAP-ZC	76	68	59	72	57	58	Low level
07CAN-Ca	69	61	57	77	63	60	Low level
07BSU-SM	63	63	72	79	60	49	Low level
03ASR-SM		86	83		31	30	Low level

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* Based on all sites, i.e. with drip, low level, furrow and overhead irrigation

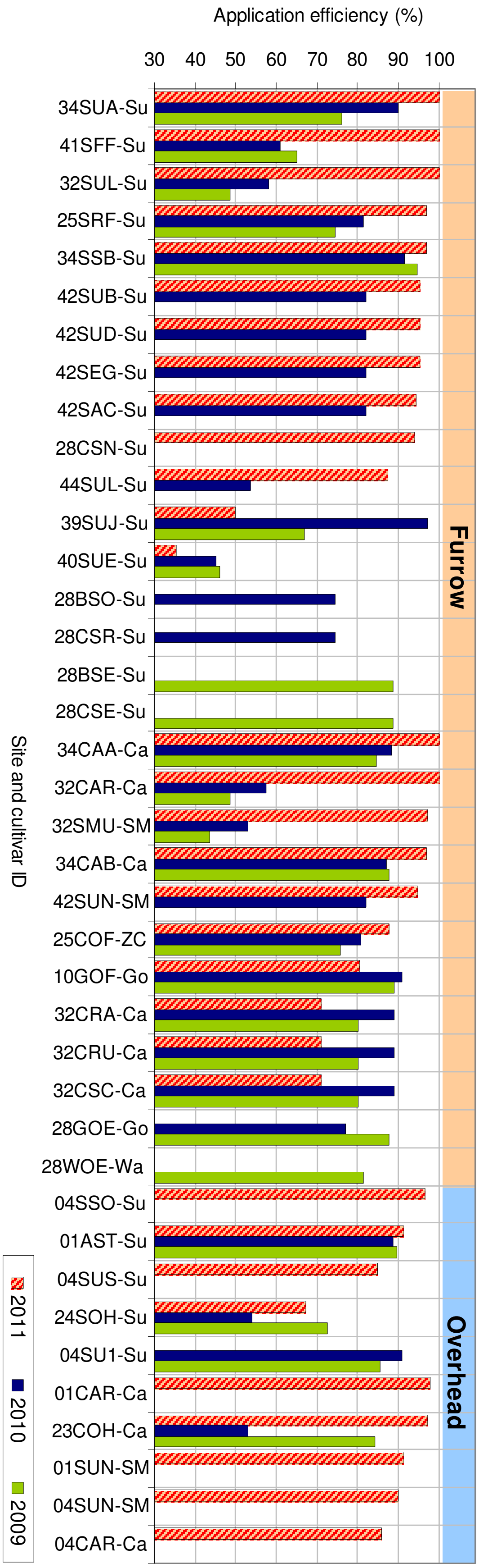


Figure 12b: Application efficiency at sites using furrow or overhead irrigation

Ca: Carina, Go: Gordo, Su: Sultana, SM: Sunmuscat, Wa: Waltham, ZC: Zante currant

Table 8b: Sites using furrow or overhead irrigation ranked with respect to the highest application efficiency

	Application efficiency						
	(%)			Rank*			
Site	2011	2010	2009	2011	2010	2009	
34SUA-Su	100	90	76	1	13	41	Furrow
41SFF-Su	100	61	65	1	62	52	Furrow
32SUL-Su	100	58	49	1	66	63	Furrow
25SRF-Su	97	81	75	13	39	44	Furrow
34SSB-Su	97	92	95	14	9	8	Furrow
42SUB-Su	96	82		17	33		Furrow
42SUD-Su	96	82		17	33		Furrow
42SEG-Su	95	82		19	33		Furrow
42SAC-Su	94	82		23	33		Furrow
28CSN-Su	94			24			Furrow
44SUL-Su	88	54		59	71		Furrow
39SUJ-Su	50	97	67	80	1	51	Furrow
40SUE-Su	35	45	46	81	74	64	Furrow
28BSO-Su		75			51		Furrow
28CSR-Su		75			51		Furrow
28BSE-Su			89			20	Furrow
28CSE-Su			89			20	Furrow
34CAA-Ca	100	89	85	1	21	27	Furrow
32CAR-Ca	100	58	49	1	67	62	Furrow
32SMU-SM	97	53	44	11	73	65	Furrow
34CAB-Ca	97	87	88	15	23	22	Furrow
42SUN-SM	95	82		22	33		Furrow
25COF-ZC	88	81	76	58	41	42	Furrow
10GOF-Go	81	91	89	68	11	19	Furrow
32CRA-Ca	71	89	80	73	17	36	Furrow
32CRU-Ca	71	89	80	73	17	36	Furrow
32CSC-Ca	71	89	80	73	17	36	Furrow
28GOE-Go		77	88		44	23	Furrow
28WOE-Wa			82			35	Furrow
04SSO-Su	97			16			Overhead
01AST-Su	91	89	90	42	20	18	Overhead
04SUS-Su	85			64			Overhead
24SOH-Su	67	54	73	78	70	47	Overhead
04SU1-Su		91	86		12	25	Overhead
01CAR-Ca	98			10			Overhead
23COH-Ca	97	53	84	12	72	28	Overhead
01SUN-SM	91			42			Overhead
04SUN-SM	90			48			Overhead
04CAR-Ca	86			61			Overhead
Maximum	100	97	100	81	74	67	
Median	92	82	82				
Minimum	35	45	30				

* Based on all sites, i.e. with drip, low level, furrow and overhead irrigation

3.2.2 Application efficiency per irrigation scheduling method

Figure 13 shows all irrigation scheduling methods achieved higher application efficiencies in 2011 and had medians within or higher than the recommended 85-90% range. Those using experience alone to schedule their irrigation had higher average results compared to those who used other methods. In terms of variation between sites using the same method, the results for sites using tensiometers were more homogeneous, especially compared to sites using gypsum blocks. The latter method had also a greater number of sites with results below 85%.

The average seasonal application efficiency of each scheduling method over the last nine seasons is presented in Table 9. In season 2010/11, growers using experience alone had an average application efficiency of 93%, while the other methods had individual averages within the recommended 85-90% range.

In terms of average for the nine-year period, sites using tensiometers achieved 85%, i.e. slightly higher than the results at sites using capacitance probes (82%) or the evaporation method (83%).

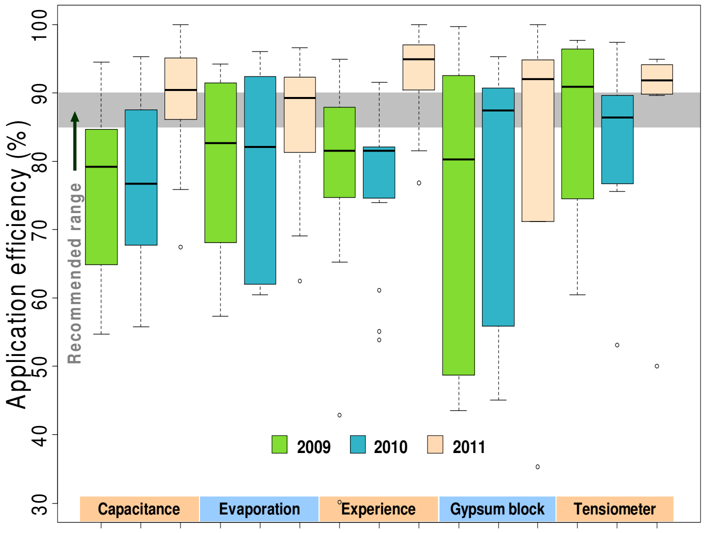


Figure 13: Box plot of irrigation application efficiency per irrigation scheduling method for 2009, 2010 and 2011

Table 9: Average application efficiency - Irrigation scheduling method comparison

Season	Average application efficiency (%)				
	Capacitance	Evaporation	Experience	Gypsum block	Tensiometer
2002/03	90	87	67		87
2003/04	86	92	72	87	90
2004/05	82	81	67	86	83
2005/06	86	80	71	87	87
2006/07	77	82	69	76	79
2007/08	76	90	74	78	86
2008/09	77	79	69	76	83
2009/10	77	78	76	75	79
2010/11	89	85	93	84	88
Average	**82**	**83**	**73**	**79**	**85**

3.3 Crop production per ML of water applied

Crop production per megalitre of water applied (t/ML) is another good performance indicator to compare how efficiently growers are using irrigation water. Also referred as the water use index, its calculation is based on the yield (t/ha) and water applied (ML/ha) (Equation 1, Appendix B).

The results for crop production per water applied in 2011 were higher compared to those in 2010 (Figure 14). The main reason for the higher values in 2011 is that the majority of sites had a reduction in irrigation applied that outweighed their low yields. The medians for 2011, 2010 and 2009 were 0.97 t/ML, 0.64 t/ML and 0.97 t/ML respectively. Furthermore, 50% of sites had results between 1.60 t/ML and 0.42 t/ML in 2011, 0.87 t/ML and 0.40 t/ML in 2010, and 1.40 t/ML and 0.71 t/ML in 2009.

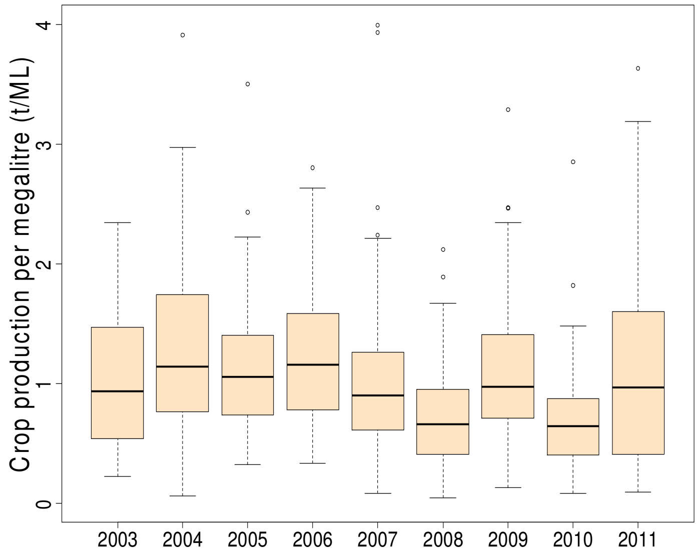


Figure 14: Box plot of crop production per megalitre of water applied between 2003 and 2011

3.3.1 Crop production per megalitre of water applied - Irrigation system type comparison

Figure 5 shows the crop production per water applied accordng to irrigation system. In 2011, drip and overhead irrigated sites had higher results compared to sites with other irrigation systems. The results for overhead irrigated sites in 2011 were also well above the results for the same system in 2009 and 2010. Irrespective of irrigation system type, there were bigger variations between the performances of different sites in 2011. In most cases, the low values in the last season were caused by poor yields, while the high values were the result of the yields obtained with much less irrigation.

Figures 16a and 16b and ranks in Tables 10a and 10b compare the performances of different sites and irrigation systems according to the crop production per water applied. With six sites among the top ten ranks in 2011, drip irrigated sites continued to have the greatest number of well ranked performances. In terms of variety, nine sites in the top ten ranked sites were growing varieties other than Sultana in 2011, i.e. four sites with Carina, three with Gordo and two with Sunmuscat.

As observed in the previous seasons, there were again great variations between performances within the same group of variety and irrigation system, e.g. values under drip irrigation ranging from 0.3 t/ML to 2.1 t/ML for Sultana and from 0.2 t/ML to 3.6 t/ML for other varieties.

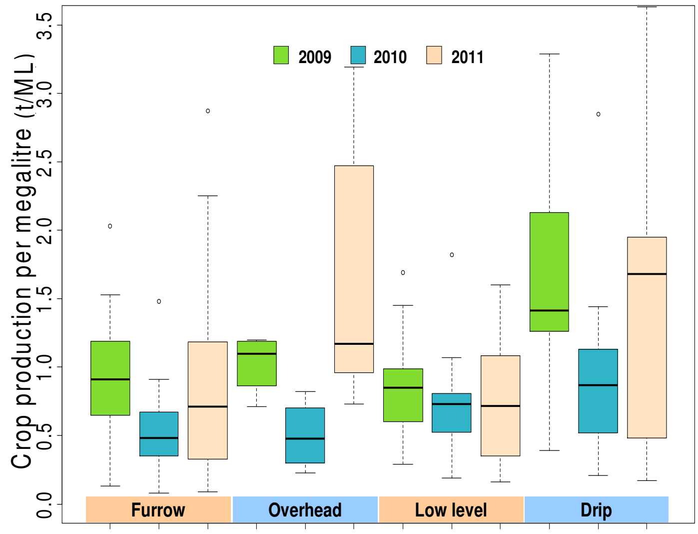
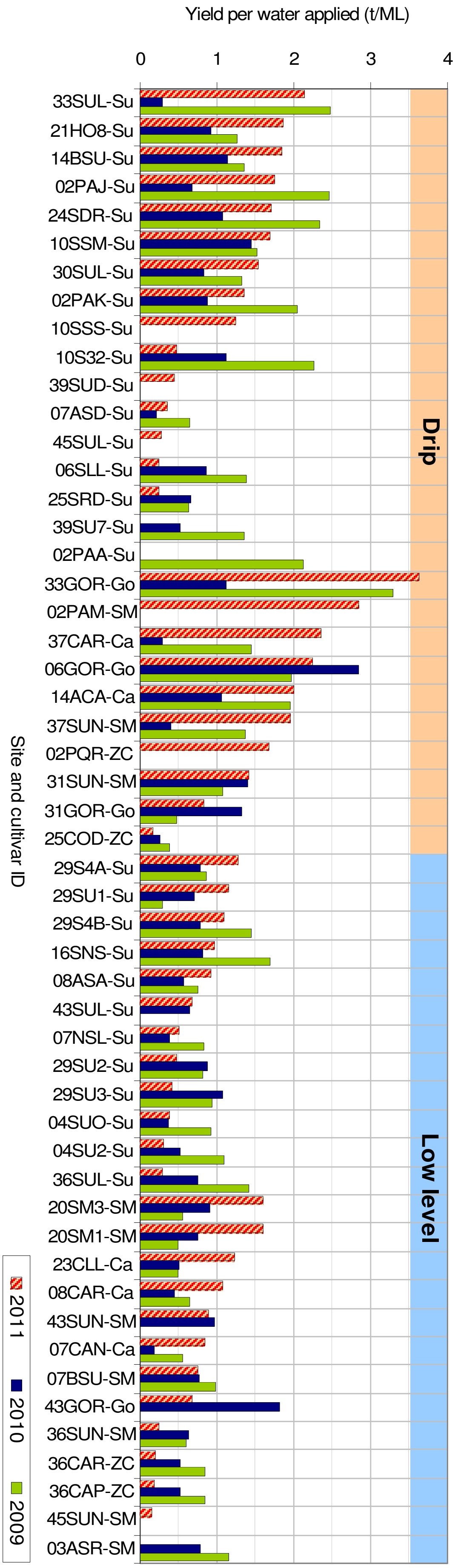


Figure 15: Box plot of crop production per megalitre of water applied for 2009, 2010 and 2011

Figure 16a: Crop production per megalitre at sites using drip or low level irrigation



Ca: Carina, Go: Gordo, Su: Sultana, SM: Sunmuscat,
Wa: Waltham, ZC: Zante currant

Table 10a: Sites using drip or low level irrigation ranked with respect to the highest crop production per megalitre

Site	Crop production per megalitre (t/ML) 2011	2010	2009	Rank* 2011	2010	2009	
33SUL-Su	2.1	0.3	2.5	**9**	63	**2**	Drip
21HO8-Su	1.9	0.9	1.3	12	14	23	Drip
14BSU-Su	1.8	1.1	1.4	13	**7**	20	Drip
02PAJ-Su	1.8	0.7	2.5	14	34	**3**	Drip
24SDR-Su	1.7	1.1	2.3	15	**10**	**4**	Drip
10SSM-Su	1.7	1.4	1.5	16	**4**	14	Drip
30SUL-Su	1.5	0.8	1.3	20	22	22	Drip
02PAK-Su	1.4	0.9	2.1	23	19	**7**	Drip
10SSS-Su	1.3			26			Drip
10S32-Su	0.5	1.1	2.3	49	**8**	**5**	Drip
39SUD-Su	0.4			52			Drip
07ASD-Su	0.4	0.2	0.6	56	68	52	Drip
45SUL-Su	0.3			59			Drip
06SLL-Su	0.3	0.9	1.4	62	21	18	Drip
25SRD-Su	0.3	0.7	0.6	62	36	53	Drip
39SU7-Su		0.5	1.4		46	20	Drip
02PAA-Su			2.1			**6**	Drip
33GOR-Go	3.6	1.1	3.3	**1**	**9**	**1**	Drip
02PAM-SM	2.9			**4**			Drip
37CAR-Ca	2.4	0.3	1.5	**6**	64	15	Drip
06GOR-Go	2.2	2.9	2.0	**8**	**1**	**9**	Drip
14ACA-Ca	2.0	1.1	2.0	**10**	12	**10**	Drip
37SUN-SM	2.0	0.4	1.4	11	55	19	Drip
02PQR-ZC	1.7			17			Drip
31SUN-SM	1.4	1.4	1.1	22	**5**	31	Drip
31GOR-Go	0.8	1.3	0.5	41	**6**	62	Drip
25COD-ZC	0.2	0.3	0.4	67	65	63	Drip
29S4A-Su	1.3	0.8	0.9	25	26	41	Low level
29SU1-Su	1.2	0.7	0.3	29	32	65	Low level
29S4B-Su	1.1	0.8	1.5	31	26	15	Low level
16SNS-Su	1.0	0.8	1.7	35	23	11	Low level
08ASA-Su	0.9	0.6	0.8	37	42	48	Low level
43SUL-Su	0.7	0.7		46	37		Low level
07NSL-Su	0.5	0.4	0.8	48	58	44	Low level
29SU2-Su	0.5	0.9	0.8	49	18	45	Low level
29SU3-Su	0.4	1.1	0.9	53	11	35	Low level
04SUO-Su	0.4	0.4	0.9	54	60	37	Low level
04SU2-Su	0.3	0.5	1.1	57	46	30	Low level
36SUL-Su	0.3	0.8	1.4	58	31	17	Low level
20SM3-SM	1.6	0.9	0.6	18	15	56	Low level
20SM1-SM	1.6	0.8	0.5	18	30	60	Low level
23CLL-Ca	1.2	0.5	0.5	27	48	60	Low level
08CAR-Ca	1.1	0.4	0.7	32	53	51	Low level
43SUN-SM	0.9	1.0		39	13		Low level
07CAN-Ca	0.8	0.2	0.6	40	69	56	Low level
07BSU-SM	0.8	0.8	1.0	42	28	33	Low level
43GOR-Go	0.7	1.8		46	**2**		Low level
36SUN-SM	0.2	0.6	0.6	64	38	54	Low level
36CAR-ZC	0.2	0.5	0.9	65	44	42	Low level
36CAP-ZC	0.2	0.5	0.9	66	44	42	Low level
45SUN-SM	0.2			68			Low level
03ASR-SM		0.8	1.2		25	29	Low level

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* Based on all sites, i.e. with drip, low level, furrow and overhead irrigation

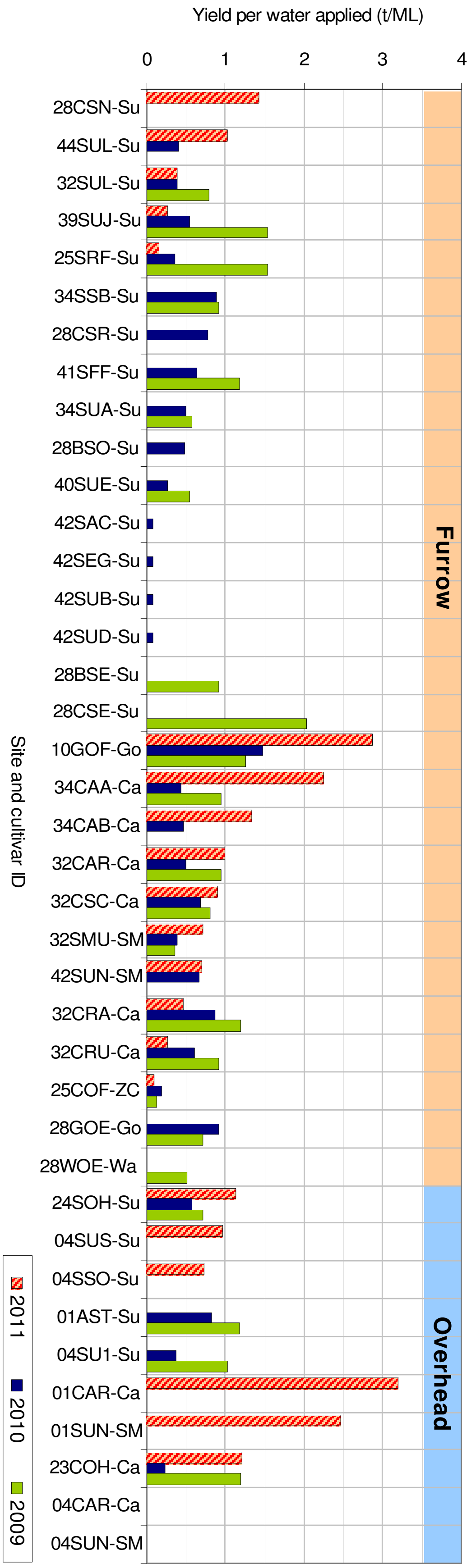

Figure 16b: Crop production per megalitre at sites using furrow or overhead irrigation

Ca: Carina, Go: Gordo, Su: Sultana, SM: Sunmuscat, Wa: Waltham, ZC: Zante currant

Table 10b: Sites using furrow or overhead irrigation ranked with respect to the highest crop production per megalitre

	Crop production per megalitre (t/ML)			Rank*			
Site	2011	2010	2009	2011	2010	2009	
28CSN-Su	1.4			21			Furrow
44SUL-Su	1.0	0.4		33	55		Furrow
32SUL-Su	0.4	0.4	0.8	54	58	47	Furrow
39SUJ-Su	0.3	0.5	1.5	61	43	12	Furrow
25SRF-Su	0.2	0.4	1.5	69	62	12	Furrow
34SSB-Su		0.9	0.9		17	38	Furrow
28CSR-Su		0.8			28		Furrow
41SFF-Su		0.6	1.2		38	27	Furrow
34SUA-Su		0.5	0.6		49	55	Furrow
28BSO-Su		0.5			51		Furrow
40SUE-Su		0.3	0.5		65	58	Furrow
42SAC-Su		0.1			71		Furrow
42SEG-Su		0.1			71		Furrow
42SUB-Su		0.1			71		Furrow
42SUD-Su		0.1			71		Furrow
28BSE-Su			0.9			38	Furrow
28CSE-Su			2.0			8	Furrow
10GOF-Go	2.9	1.5	1.3	3	3	23	Furrow
34CAA-Ca	2.3	0.4	0.9	7	54	35	Furrow
34CAB-Ca	1.3	0.5		24	52		Furrow
32CAR-Ca	1.0	0.5	1.0	34	49	34	Furrow
32CSC-Ca	0.9	0.7	0.8	38	33	46	Furrow
32SMU-SM	0.7	0.4	0.4	44	57	64	Furrow
42SUN-SM	0.7	0.7		45	34		Furrow
32CRA-Ca	0.5	0.9	1.2	51	19	25	Furrow
32CRU-Ca	0.3	0.6	0.9	60	40	38	Furrow
25COF-ZC	0.1	0.2	0.1	70	70	66	Furrow
28GOE-Go		0.9	0.7		15	49	Furrow
28WOE-Wa			0.5			59	Furrow
24SOH-Su	1.1	0.6	0.7	30	41	50	Overhead
04SUS-Su	1.0			36			Overhead
04SSO-Su	0.7			43			Overhead
01AST-Su		0.8	1.2		23	27	Overhead
04SU1-Su		0.4	1.0		60	32	Overhead
01CAR-Ca	3.2			2			Overhead
01SUN-SM	2.5			5			Overhead
23COH-Ca	1.2	0.2	1.2	28	67	25	Overhead
04CAR-Ca							Overhead
04SUN-SM							Overhead
Maximum	3.6	2.9	3.3	70	74	66	
Median	1.0	0.6	1.0				
Minimum	0.1	0.1	0.1				

* Based on all sites, i.e. with drip, low level, furrow and overhead irrigation

Table 11: Average crop production per megalitre of water applied - Irrigation system type comparison

Season	**Average crop production per megalitre (t/ML)**				
	Drip	**Furrow**	**Low level**	**Overhead**	**Average**
2002/03	1.14	0.71	1.12	0.72	**0.92**
2003/04	1.38	0.89	1.68	0.91	**1.22**
2004/05	1.14	0.87	1.28	1.21	**1.13**
2005/06	1.12	1.26	1.12	1.31	**1.20**
2006/07	1.17	0.86	1.05	0.85	**0.98**
2007/08	0.91	0.61	0.57	0.66	**0.69**
2008/09	1.60	0.81	0.87	1.03	**1.08**
2009/10	0.92	0.48	0.71	0.50	**0.65**
2010/11	1.45	0.92	0.75	1.62	**1.19**
Average	**1.22**	**0.82**	**0.98**	**0.99**	**1.01**

Table 12: Average crop production per megalitre of water applied - Variety and irrigation system type comparison

	Sunmuscat	1.43	2.36	1.27	1.21	0.92	0.49	0.76	0.81	0.87	**1.03**
	Waltham			0.75	0.52	0.52					**0.60**
Overhead	Carina	1.05	0.76	1.17	1.45	1.23	0.66	1.20	0.23	2.20	**1.20**
	Sultana	0.69	0.96	1.22	1.27	0.74	0.66	0.97	0.61	0.94	**0.91**
	Sunmuscat	0.55				0.71				2.47	**1.24**
Furrow	Carina					0.66	0.44	0.94	0.59	1.04	**0.73**
	Currant	0.21	0.22	0.59	0.73	0.26	0.15	0.13	0.18	0.09	**0.28**
	Gordo		1.47	1.32	1.65	0.97	0.83	0.79	1.09	2.87	**1.37**
	Sultana	0.84	0.91	0.84	1.20	1.05	0.68	0.91	0.36	0.65	**0.83**
	Sunmuscat					0.55	0.64	0.36	0.53	0.71	**0.56**
	Waltham			0.42	1.33	1.07	0.74	0.40			**0.79**

The results for the nine seasons in Table 11 indicate overhead and drip irrigated sites had respectively their highest (1.62 t/ML) and second highest (1.45 t/ML) seasonal average crop production per water applied in 2010/11. These results were approximately twice as much as the average 0.75 t/ML obtained at sites with low level irrigation systems. Furthermore, the seasonal averages for furrow and low level irrigated sites in 2010/11 were lower than their respective average for the nine-year period.

Table 12 shows the average performance of sites according to their variety and irrigation system group. The highest average performance in 2010/11 was obtained at sites with furrow irrigation and growing Gordo (2.87 t/ML). While the results in 2010/11 were among the highest performances achieved so far, there were a few exceptions such as the low average at sites growing Currant either with low level (0.2 t/ML) or furrow (0.09 t/ML) irrigation systems. Otherwise on the nine-year period, drip irrigated sites growing Gordo had the highest average performance (1.87 t/ML).

3.4 Gross return per ML of water applied

Gross return per megalitre of water applied ($/ML) is the ratio between the sale price of the produce per hectare ($/ha) and the volume of irrigation water applied (ML/ha) over the season (Equation 2, Appendix B). It can also be calculated by multiplying the price per tonne of fruit ($/t) and the crop production per water applied (t/ML). Differences in gross return between sites and between seasons occur as a result of differences in yields, irrigation applications and price of dried vine fruit. Gross return per megalitre of water applied does not consider input costs and therefore does not give an indication of growers' profits. This performance indicator should be treated only as technical information, and is therefore not appropriate for a sound economic analysis.

Figure 17 shows a big variation between the performances of different sites in 2011. The results for 50% of the sites varied between $658/ML and $2624/ML, with a median ($1642/ML) higher than in 2010 ($1130/ML) but lower than the $1784/ML in 2009. The relatively low irrigation applied in 2011 was the main factor that contributed to the high gross return per megalitre values at some sites. However at other sites, the very low yields far outweighed the effects of the lower irrigation applied.

3.4.1 Gross return per water applied - irrigation system type comparison

Table 13 shows the average gross return per megalitre of water applied for each irrigation system type per season. The seasonal average for overhead ($2852/ML) and drip ($2512/ML) irrigated sites were much higher than the averages for furrow ($1624/ML) and low level ($1247/ML) irrigated sites. The result for overhead irrigated sites in 2010/11 was furthermore the highest average obtained with that system, and the second highest overall result after the $2869/ML for drip irrigated sites in 2008/09.

With the exception of low level, all other irrigation systems had a seasonal average in 2010/11 higher than their respective nine-year average. Otherwise, drip continued to be the irrigation system with the highest average gross return per megalitre ($1921/ML) over the period of study.

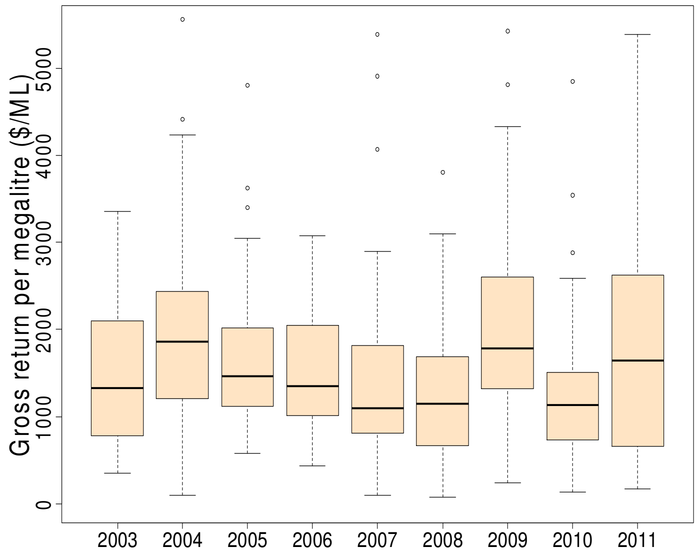

Figure 17: Box plot of gross return per megalitre of water applied between 2003 and 2011

Table 13: Average gross return per water applied ($/ML) - Irrigation system type comparison

Season	Average gross return per megalitre ($/ML)			
	Drip	Furrow	Low level	Overhead
2002/03	1651	1035	1537	1084
2003/04	2079	1305	2366	1418
2004/05	1636	1256	1843	1794
2005/06	1348	1609	1373	1531
2006/07	1577	1164	1362	1267
2007/08	1595	999	990	1130
2008/09	2869	1511	1582	1855
2009/10	1602	860	1278	862
2010/11	2512	1624	1247	2852
Average	**1921**	**1263**	**1469**	**1522**

Table 14: Average gross return per water applied ($/ML) - Variety comparison

Variety	Average gross return per megalitre ($/ML)									
	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	Average
Carina	1652	1485	1955	1640	1419	828	1894	968	2600	**1605**
Currant	394	416	999	844	346	195	1051	704	860	**645**
Gordo	3245	3235	1996	2389	2148	1628	2436	2745	3590	**2601**
Sultana	1434	1946	1659	1367	1369	1293	2224	1064	1491	**1601**
Sunmuscat	1342	2507	1624	1324	1036	1311	1466	1344	2165	**1568**
Waltham			950	1514	1312	1081	766			**1125**

3.4.2 Gross return per megalitre of water applied - variety comparison

The average gross return per water applied presented in Table 14 shows Gordo had once again the highest seasonal average ($3590/ML) in 2010/11. Conversely, the average at sites with variety Currant ($860/ML) continued to be lower than the averages at sites with other varieties, e.g. approximately 33%, 24%, 58% and 40% of the averages for Carina, Gordo, Sultana and Sunmuscat respectively.

Except Sultana, other varieties had an individual seasonal average in 2010/11 higher than their respective nine-year average. In the case of Carina and Gordo, their averages in the last season were their highest performances obtained so far and respectively $980/ML and $947/ML more than their nine-year averages.

3.5 Cost of water per tonne of fruit

Cost of water per tonne of fruit is calculated using Equation 3 (Appendix B) and is influenced by many factors within irrigation systems and seasons. Inputs comprise the cost of irrigation water, the cost of on-peak and off-peak electricity for pumping, the total number of irrigation hours and the yield produced. It should not be therefore interpreted as being definitive due to the number of variables involved in the calculation.

Figure 18 shows the cost of water per tonne of fruit in 2011 was lower compared to the results for years 2008, 2009 and 2010. The results for 75% of sites in 2011 were less than $210/t. As a comparison, in 2008, 2009 and 2010 the same percentage of sites had results less than $457/t, $254/t and $319/t respectively. While in 2011 the small amount of irrigation applied resulted in the lower cost of water per tonne of fruit at many sites, the high values in 2008 and 2010 were mainly due to the combined effects of low yields and high water usage costs.

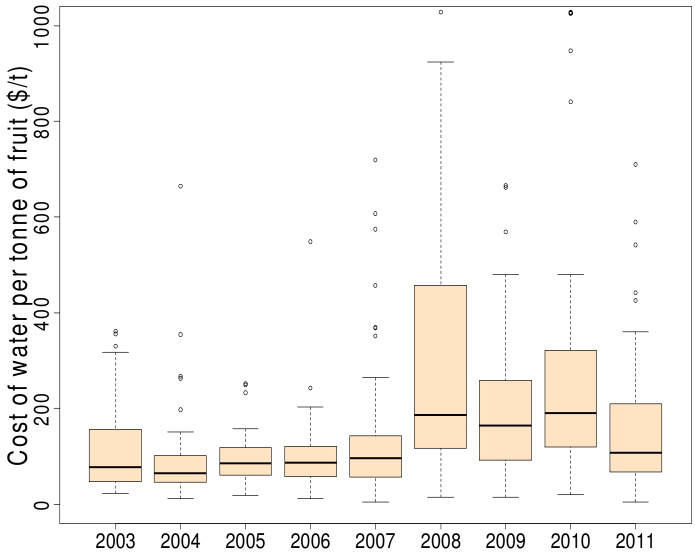

Figure 18: Box plot of cost of water per tonne of fruit between 2003 and 2011

3.5.1 Cost of water per tonne of fruit - irrigation system type comparison

Table 15 shows the average cost of water per tonne of fruit for each irrigation system type and season. The seasonal average for each system in 2010/11 was generally lower compared to the results in the three previous seasons. Irrespective of irrigation system, the average for overhead irrigated sites ($74/t) in 2011 was the second lowest result over the studied period. In terms of nine-year averages, low level irrigated sites had the highest cost of water per tonne of fruit ($260/t) while drip irrigated sites had the lowest average ($144/t).

Table 15: Average cost of water per tonne of fruit - Irrigation system type comparison

Season	Average cost of water per tonne of fruit ($/t)			
	Drip	Furrow	Low level	Overhead
2002/03	122	90	102	152
2003/04	113	79	76	118
2004/05	86	101	105	80
2005/06	105	72	122	76
2006/07	127	191	126	151
2007/08	216	197	868	344
2008/09	164	205	288	169
2009/10	217	312	412	201
2010/11	127	218	166	74
Average	**144**	**193**	**260**	**147**

3.6 Gross return per dollar water input

This indicator compares dollar returns from the sale of fruit with the expenditure on water to produce that fruit ($/$). It is strongly influenced by water costs and the gross return from crop production. Water costs often differ between growers according to the supply source and its associated cost structure. As already pointed out, this type of indicator is only for technical information and is not appropriate for a sound economic comparison.

Figure 19 shows the results in 2011 were higher, and with a bigger variation, than the results in the preceding six years, i.e. since 2005. The median in 2011 (16.9) was 83%, 51% and 81% higher than the medians in 2010 (9.2), 2009 (11.2) and 2008 (9.3) respectively. The low irrigation applied and low water usage costs in 2011 resulted in higher gross return per dollar water input at sites not significantly affected by diseases and yield reductions. On the other hand, sites with very low yields achieved low gross return per dollar water input despite their low water input costs.

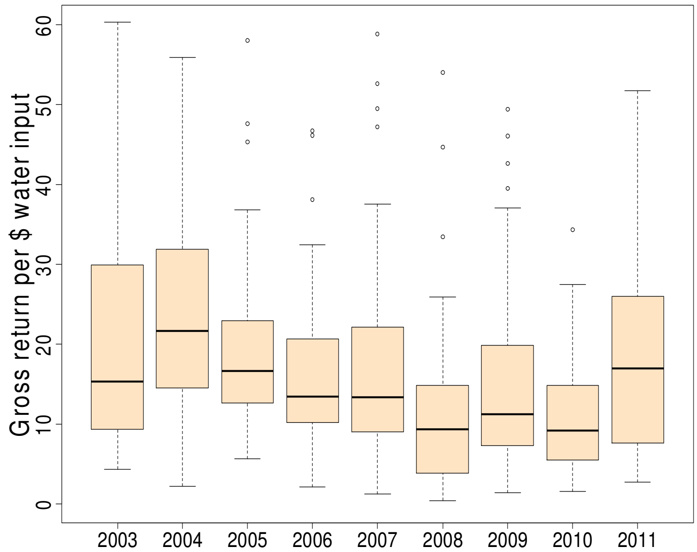

Figure 19: Box plot of gross return per dollar water input between 2003 and 2011

Table 16 shows the average gross return per dollar water input for drip irrigated sites in 2010/11 (47) was higher than the results for sites with overhead (43), furrow (17) and low level (17) irrigation systems. The results for drip and overhead irrigated sites in 2010/11 were approximately thrice their performances in 2009/10 and twice their nine-year averages. Over the nine-year period, drip irrigated sites had the highest average (29), followed by overhead irrigated sites (21).

Table 16: Average gross return per dollar water input ($/$) - Irrigation system type comparison

Season	Average gross return per dollar water input ($/$)			
	Drip	Furrow	Low level	Overhead
2002/03	25	24	21	11
2003/04	34	22	29	17
2004/05	27	16	19	22
2005/06	20	21	14	19
2006/07	49	16	17	30
2007/08	20	12	6	14
2008/09	26	13	11	13
2009/10	15	10	9	12
2010/11	47	17	17	43
Average	**29**	**15**	**15**	**21**

Conclusions

- The study continued to attract growers' interest, with an increasing number of participants and field sites since season 2002/03.
- Season 2010/11 was a bad year in terms of yield for many growers. This was mostly as a result of the favourable conditions for diseases and loss in fruit quality associated with the above normal rainfall events during summer.
- The higher effective rainfall during summer 2010/11 considerably reduced the need for supplementary irrigation. As expected, the irrigation water applied at most sites in 2011 was much lower than in the previous years.
- Throughout the nine-year period, sites using the tensiometer method applied on average the least amount of water, i.e. 5.3 ML/ha.
- The results in 2011 showed some sites had high application efficiencies but with zero yields and low water applications. This illustrates the point that irrigation application efficiency is a useful performance indicator only when it is used in conjunction with other performance indicators such as yield and water applied.
- Over the nine-year period, drip irrigation was the most reliable system to achieve application efficiencies within the recommended 85-90% range.
- The results of crop production per megalitre of water applied at most sites were generally higher in 2011 compared to 2010. In most cases, the higher values were the result of the yields obtained with much less irrigation.
- A variety comparison showed Gordo had consistently the highest seasonal average gross return per megalitre of water applied ($3590/ML in 2010/11). Conversely, Currant ($860/ML) continued to be the lowest performing variety.

Appendix

A. Further reading

- Giddings, J., Kelly, S., Chalmers, Y., & Cook, H. (2002). Winegrape irrigation benchmarking Murray-Darling and Swan Hill 1998-2002. In Dundon, C., Hamilton, R., Johnstone, R., & Partrigde, S. (Eds.), Managing Water (pp. 15–18), Adelaide, SA. Australian Society of Viticulture and Oenology.
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- Sommer, K. J. & Pollock, L. (2008c). Table grape irrigation benchmarking 2002-2008. Technical report, Department of Primary Industries, Victoria.
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- Toll, Z. & Burrows, D. (2006b). Dried vine fruit irrigation benchmarking 2002-2006. Technical report, Department of Primary Industries, Victoria.
- Toll, Z. (2006c). Open hydroponics irrigation benchmarking 2002-2005. Technical report, Department of Primary Industries, Victoria.
- Toll, Z. (2006d). Open hydroponics irrigation benchmarking 2002-2006. Technical report, Department of Primary Industries, Victoria.
- Toll, Z. & Burrows, D. (2006e). Potato centre pivot irrigation benchmarking 2002-2005. Technical report, Department of Primary Industries, Victoria.
- Toll, Z. & Burrows, D. (2006f). Table grape irrigation benchmarking 2002-2006. Technical report, Department of Primary Industries, Victoria.
- Vargas, J. (2005a). Almond irrigation benchmarking 2002-2005. Technical report, Department of Primary Industries, Victoria.
- Vargas, J. (2005b). Dried fruit irrigation benchmarking 2002-2005. Technical report, Department of Primary Industries, Victoria.
- Vargas, J. (2005c). Table grape irrigation benchmarking 2002-2005. Technical report, Department of Primary Industries, Victoria

B. Performance indicator formulas

1. $$\textbf{Crop production per ML (t/ML)} = \frac{\text{Yield (t/ha)}}{\text{Water applied (ML/ha)}}$$

2. $$\textbf{Gross return per ML (\$/ML)} = \frac{\text{Yield (t/ha)} \times \text{Assigned value (\$/t)}}{\text{Water applied (ML/ha)}}$$

3. $$\textbf{Cost of water per tonne of fruit (\$/t)} = \frac{\text{Cost of water applied per ha (\$/ha)}}{\text{Yield (t/ha)}}$$

4. $$\textbf{Cost of water applied per ha (\$/ha)} = \left(\text{Cost of water (\$/ML)} + \text{pumping cost (\$/ML)}\right) \times \text{water applied (ML/ha)}$$

5. $$\textbf{Gross return per dollar water input} = \frac{\text{Yield (t/ha)} \times \text{Assigned value (\$/t)}}{\text{Cost of water applied per ha (\$/ha)}}$$

6. $$\textbf{Application efficiency (\%)} = \frac{\left(\text{Water applied (ML/ha) - drainage (ML/ha)}\right) \times 100}{\text{Water applied (ML/ha)}}$$

7. $$\textbf{Yield per volume of drainage (t/ML)} = \frac{\text{Yield (t/ha)}}{\text{Estimated drainage (ML/ha)}}$$

8. $$\textbf{Cost of drainage per tonne (\$/t)} = \frac{\text{Cost of drainage per ha (\$/ha)}}{\text{Yield (t/ha)}}$$

9. $$\textbf{Cost of drainage per ha (\$/ha)} = \left(\text{Cost of water (\$/ML)} + \text{pumping cost (\$/ML)}\right) \times \text{estimated drainage (ML/ha)}$$

C. Performance indicator tables

Site	Age	Scheduling Method	System Type	Variety	Assigned value ($/t)								
					2003	2004	2005	2006	2007	2008	2009	2010	2011
01AST	31	Capacitance - Logging	Overhead	Sultana	1435	1485	1400	1160	1330	1600	1725	1700	
01CAR	14	Capacitance - Logging	Overhead	Carina									1930
01SUN	10	Capacitance - Logging	Overhead	Sunmuscat									1775
02PAA	13	Experience only	Overhead	Sultana	1435	1485	1300	1090	1180	1800			
02PAA	14	Gypsum block - Logging	Drip	Sultana							1955		
02PAJ	20	Experience only	Overhead	Sultana	1435	1485	1400	1090	1150	1800			
02PAJ	23	Gypsum block - Logging	Drip	Sultana							1955	1850	1755
02PAK	17	Experience only	Overhead	Sultana	1435	1485	1420	1090	1150	1800			
02PAK	20	Gypsum block - Logging	Drip	Sultana							1955	1750	1755
02PAM	12	Gypsum block - Logging	Drip	Sunmuscat									1775
02PQR	8	Gypsum block - Logging	Drip	Currant									1830
03ASR	15	Capacitance - Logging	Low level	Sunmuscat							1700	1600	1450
03ASU	12	Capacitance - Logging	Low level	Sunmuscat	1370	1485	1300	1200	1315	1700			
04CAR	1	Evaporation data	Overhead	Carina									
04SSO	27	Evaporation data	Overhead	Sultana									1421
04SU1	23	Capacitance - Manual	Overhead	Sultana							1765	1695	
04SU2	29	Capacitance - Manual	Low level	Sultana							1765	1516	1550
04SUN	1	Evaporation data	Overhead	Sunmuscat									
04SUO	29	Capacitance - Manual	Low level	Sultana							1765	1718	1569
04SUS	27	Evaporation data	Overhead	Sultana									1536
05PAB	17	Experience only	Drip	Sultana	1435	1485	1400	1250					
05PAG	30	Experience only	Drip	Sultana	1435	1485	1400	1250					
05PDF	27	Experience only	Drip	Sultana	1435	1485	1400	1250					
06GOR	12	Capacitance - Logging	Drip	Gordo	1435	1485	1400	1138	1200	1800	1400	1700	1312
06SLL	15	Capacitance - Logging	Drip	Sultana						1815	1600	1750	1750
06SUL	11	Capacitance - Logging	Drip	Sultana	1305	1355	1400	1125	1200				
07ASD	21	Capacitance - Logging	Drip	Sultana	1435	1485	1400	1277	1280	1600	1800	1724	1283
07BSU	13	Evaporation data	Low level	Sunmuscat			1400	1190	1280	1750	1745	1771	1622
07CAH	34	Evaporation data	Low level	Currant						1565			
07CAN	35	Evaporation data	Low level	Carina							1890	1885	1660
07CAR	32	Evaporation data	Low level	Carina				1350	1335				
07DCA	30	Evaporation data	Low level	Carina			1800		1335				
07ECZ	37	Evaporation data	Low level	Currant			1400	1279	1335				
07FSL	53	Evaporation data	Low level	Sultana			1400		1340	1555			
07FWC	27	Evaporation data	Low level	Waltham Cross			1400	1675	1650				
07NSL	56	Evaporation data	Low level	Sultana							1705	1655	1283
07SLL	53	Evaporation data	Low level	Sultana				1150	1230	1750			
08ASA	22	Capacitance - Logging	Low level	Sultana	1435	1485	1400	1055	1131	1600	1930	1400	1825
08CAR	23	Capacitance - Logging	Low level	Carina	1825	1850	1800	1300	1300	1565	1900	1800	1900
10GOF	77	Evaporation data	Furrow	Gordo		1400	1400	1675	1700	1850	1950	1950	1883
10S32	25	Evaporation data	Drip	Sultana	1435	1485	1400	1300	1410	1730	1750	1750	1775
10SF2	71	Evaporation data	Furrow	Sultana				1300	1410				
10SSM	22	Evaporation data	Drip	Sultana	1435	1485	1400	1300	1315	1870	1750	1750	1775
10SSS	22	Evaporation data	Drip	Sultana									1775
10SUF	71	Evaporation data	Furrow	Sultana		1435	1400						
11CRL	14	Tensiometer - Logging	Low level	Carina	1825	1850	1800	1300	1350				
11CRO	6	Tensiometer - Logging	Overhead	Carina		1850	1800	1300	1350				
13SOR	6	Capacitance - Logging	Drip	Sultana	1435	1485	1400						
14ACA	17	Tensiometer - Manual	Drip	Carina	1825	1825	1800	1350	1350	1600	1884	1900	1830
14BSU	22	Tensiometer - Manual	Drip	Sultana	1435	1485	1400	1300	1360	1830	1861	1900	1755
15ASR	6	Capacitance - Logging	Drip	Sultana	1435	1485	1400	1083					
15BSP	6	Capacitance - Logging	Drip	Sunmuscat	1370	1485	1400	1095					
16SNS	16	Evaporation data	Low level	Sultana	1320	1520	1400	1149	1255	1800	1850	1755	1800
17GSR	14	Experience only	Furrow	Sultana	1435	1485	1435	1100	1230				
17H5S	32	Experience only	Furrow	Sultana	1435	1485	1435						
17OST	103	Experience only	Furrow	Sultana	1435	1485	1435	1100					
18AST	47	Experience only	Overhead	Sultana	1435	1485	1400	1100					
19ASM	2	Calendar	Overhead	Sunmuscat	1370								
19ASM	49	Gypsum block - Logging	Drip	Sunmuscat		1485	1400	1199	1245	1660			
20S32	10	Capacitance - Manual	Low level	Sunmuscat	978.2	1048	1400	1150	1185	1630			
20S36	48	Capacitance - Manual	Low level	Sunmuscat	978.2	1048	1400	1150	1185	1630			
20SM1	12	Capacitance - Manual	Low level	Sunmuscat							1775	1950	1645
20SM3	12	Capacitance - Manual	Low level	Sunmuscat							1775	1950	1645
21AST	44	Capacitance - Logging	Drip	Sultana	1435	1485	1350	1282	1310				
21HO8	48	Capacitance - Logging	Drip	Sultana						1750	1930	1800	1765
22SUL	6	Capacitance - Logging	Low level	Sultana	1400	1400							
22SUL	7	Capacitance - Logging	Drip	Sultana			1435						

Site	Age	Scheduling Method	System Type	Variety	Assigned value ($/t)								
					2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	20	Capacitance - Manual	Low level	Carina	1825	1850	1800	1350	1300	1610	1890	1800	1830
23COH	26	Capacitance - Manual	Overhead	Carina	1825	1850	1800	1350	1300	1610	1890	1800	1830
24SDR	47	Capacitance - Manual	Drip	Sultana		1485	1340	1100	1150	1635	1850	1725	1575
24SOH	47	Capacitance - Manual	Overhead	Sultana		1485	1340	1100	1150	1635	1850	1755	1625
25COD	18	Experience only	Drip	Currant	1825	1850	1800	1300	1250	1565	1900	1800	1930
25COF	68	Experience only	Furrow	Currant	1825	1850	1800	1300	1250	1565	1900	1800	1930
25SRD	18	Experience only	Drip	Sultana	1435	1485	1400	1200	1275	1850	1855	1800	1625
25SRF	68	Experience only	Furrow	Sultana	1435	1485	1400	1200	1275	1850	1855	1800	1625
28BSE	61	Experience only	Furrow	Sultana						1800	1930		
28BSO	62	Experience only	Furrow	Sultana								1980	
28BSU	59	Experience only	Furrow	Sultana			1400	1266	1250				
28CSE	9	Experience only	Furrow	Sultana						1800	1930		
28CSN	11	Experience only	Furrow	Sultana									1635
28CSR	10	Experience only	Furrow	Sultana								1750	
28CSU	7	Experience only	Furrow	Sultana			1400	1115	1250				
28GOE	62	Experience only	Furrow	Gordo						1800	1885	1825	
28GOR	59	Experience only	Furrow	Gordo			1190	1137	1650				
28WAC	59	Experience only	Furrow	Waltham Cross			2000	1625	1650				
28WOE	61	Experience only	Furrow	Waltham Cross						1460	1930		
29S4A	12	Capacitance - Logging	Low level	Sultana	1375	1425	1375	1200	1280	1800	1930	1930	1625
29S4B	12	Capacitance - Manual	Low level	Sultana	1375	1425	1375	1200	1280	1800	1930	1930	1625
29SU1	48	Tensiometer - Manual	Low level	Sultana	1375	1425	1375	1300	1280	1700	1930	1700	1625
29SU2	51	Tensiometer - Manual	Low level	Sultana	1375	1425	1375	1200	1280	1750	1930	1700	1625
29SU3	54	Tensiometer - Manual	Low level	Sultana		1425	1375	1200	1280	1750	1700	1930	1625
30SUL	9	Capacitance - Logging	Drip	Sultana				1100	1150	1880	1685	1630	1699
31CUR	85	Tensiometer - Manual	Furrow	Currant					1350				
31GOR	40	Tensiometer - Manual	Furrow	Gordo					1650				
31GOR	44	Tensiometer - Manual	Drip	Gordo						1790	1950	1950	1688
31SUL	80	Tensiometer - Manual	Furrow	Sultana					1350				
31SUN	11	Tensiometer - Manual	Drip	Sunmuscat						1850	1745	1745	1674
32CAR	9	Gypsum block - Logging	Furrow	Carina					1300	1615	1890	1890	1780
32CRA	6	Gypsum block - Logging	Furrow	Carina						1615	1890	1890	1780
32CRU	6	Gypsum block - Logging	Furrow	Carina					1300	1615	1890	1890	1780
32CSC	15	Gypsum block - Logging	Furrow	Carina					1300	1615	1890	1890	1780
32SMU	11	Gypsum block - Logging	Furrow	Sunmuscat					1185	1820	1750	1944	1722
32SUL	9	Gypsum block - Logging	Furrow	Sultana					1330	1850	1800	1925	1705
33GOR	10	Tensiometer - Manual	Drip	Gordo					1650	1850	1650	1185	1950
33SUL	10	Tensiometer - Manual	Drip	Sultana					1653	1800	1755	1470	1625
34CAA	19	Experience only	Furrow	Carina					1350		1890	1765	1930
34CAB	19	Experience only	Furrow	Carina					1350			1765	1930
34SSB	19	Experience only	Furrow	Sultana							1725	1600	
34SUA	19	Experience only	Furrow	Sultana					1205	1050	1725	1600	
34SUB	16	Experience only	Furrow	Sultana					1205	1050			
35SNO	9	Tensiometer - Manual	Overhead	Sultana					3850				
36CAP	8	Capacitance - Manual	Low level	Currant							1900	1900	1900
36CAR	8	Capacitance - Manual	Low level	Currant							1900	1900	1900
36SUL	11	Capacitance - Manual	Low level	Sultana					1330	1850	1700	1900	1900
36SUN	13	Capacitance - Manual	Low level	Sunmuscat					1345	1800	1700	1700	1700
37CAR	13	Capacitance - Manual	Drip	Carina					1350	1565	1900	1900	1900
37SUN	11	Capacitance - Manual	Drip	Sunmuscat						1760	1930	1759	1700
39SU7	13	Gypsum block - Manual	Overhead	Sultana						1630			
39SU7	15	Gypsum block - Manual	Drip	Sultana							1700	1700	
39SUD	16	Gypsum block - Manual	Drip	Sultana									1500
39SUJ	16	Tensiometer - Manual	Furrow	Sultana						1830	1700	1700	1500
39SUS	12	Gypsum block - Manual	Overhead	Sunmuscat					1250				
40SUE	65	Gypsum block - Manual	Furrow	Sultana						1780	1930	1750	
40SUL	61	Tensiometer - Manual	Furrow	Sultana					1370				
41SFF	17	Experience only	Furrow	Sultana							1850	1750	
42SAC	27	Experience only	Furrow	Sultana								1650	
42SEG	23	Experience only	Furrow	Sultana								1650	
42SUB	80	Experience only	Furrow	Sultana								1650	
42SUD	80	Experience only	Furrow	Sultana								1650	
42SUN	13	Experience only	Furrow	Sunmuscat								1750	1675
43GOR	6	Experience only	Low level	Gordo								1950	1669
43SUL	19	Experience only	Low level	Sultana								1750	1482
43SUN	7	Experience only	Low level	Sunmuscat								1450	1444
44SUL	41	Experience only	Furrow	Sultana								1470	1106
45SUL	17	Evaporation data	Drip	Sultana									1225
45SUN	15	Evaporation data	Low level	Sunmuscat									1880

Site	Gross return per $ water input									Application efficiency (%)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	15	20	14	18	47	4	6	34	124	74	80	73	78	81	63	84	80	88
23COH	24	25	26	21	37	5	12	16	81	98	90	91	90	86	85	84	53	97
24SDR		131	73	98	71	109	17	16	70		96	95	99	89	93	92	92	95
24SOH		33	48	46	22	45	11	15	48		65	66	80	56	65	73	54	67
25COD	5	5	7	5	2	3	9	6	4	31	30	31	32	29	31	30	55	77
25COF	12	12	13	12	5	2	3	6	3	88	90	87	97	64	81	76	81	88
25SRD	4	10	9	6	10	8	14	14	5	48	45	50	48	38	60	43	81	81
25SRF	9	21	16	13	11	18	34	8	3	88	90	87	97	64	81	75	81	97
28BSE						9	9								98	89		
28BSO								11									75	
28BSU			12	16	59							60	83	96				
28CSE						15	20								98	89		
28CSN									26									94
28CSR								15									75	
28CSU			22	31	20							60	83	95				
28GOE						15	7	19							97	88	77	
28GOR			10	19	22							61	83	80				
28WAC			13	32	53							61	83	80				
28WOE						11	3								93	82		
29S4A	24	41	35	18	9	4	4	2	21	90	93	94	99	89	90	76	77	100
29S4B	40	69	58	30	19	4	4	2	18	93	95	95	100	95	99	97	77	100
29SU1	9	17	17	13	22	1	1	2	19	88	95	92	99	87	88	75	76	94
29SU2	27	46	37	20	22	1	5	2	8	89	94	95	99	90	89	61	76	95
29SU3		29	26	24	15	1	4	2	7	87	95	91	99	85	82	74	86	91
30SUL				14	26	13	8	6	24				77	87	88	82	78	92
31CUR					7									62				
31GOR					5									71				
31GOR						6	3	9	14						95	96	93	90
31SUL					4									65				
31SUN						15	7	10	23						98	91	87	92
32CAR					13	9	15	11	20					68	60	49	58	100
32CRA						9	16	20	9					72	93	80	89	71
32CRU					1	8	12	14	5					72	93	80	89	71
32CSC					11	9	10	16	18					72	93	80	89	71
32SMU					8	15	5	9	14					67	54	44	53	97
32SUL					20	8	12	9	7					68	60	49	58	100
33GOR					310	8	14	10	392					95	93	97	90	90
33SUL					206	9	11	3	193					95	95	98	90	92
34CAA					13		22	9	48					66	100	85	89	100
34CAB					17			10	29					92	100	88	87	97
34SSB							19	17								95	92	97
34SUA					10	10	12	9						66	100	76	90	100
34SUB					14	16								74	100			
35SNO					149									83				
36CAP							16	7	7							59	68	76
36CAR							13	7	7							59	68	80
36SUL					38	8	28	12	14					66	64	61	69	86
36SUN					29	7	10	8	8					57	52	55	56	80
37CAR					15	22	129	9	70					55	49	79	68	89
37SUN						26	46	12	52						51	79	75	89
39SU7						4									77			
39SU7							9	9								92	86	
39SUD									5									88
39SUJ						23	7	8	3						85	67	97	50
39SUS					9									69				
40SUE						9	12	5							52	46	45	35
40SUL					16									51				
41SFF							11	13								65	61	100
42SAC								2									82	94
42SEG								2									82	95
42SUB								2									82	95
42SUD								2									82	95
42SUN								14	13								82	95
43GOR								27	8								84	93
43SUL								9	7								74	93
43SUN								10.9	9.2								75	85
44SUL								5.5	9.9								54	88
45SUL									10.3									91

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Site	Water applied (ML/ha)									Estimated drainage (ML/ha)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	5.86	6.55	7.91	6.23	5.45	5.82	4.64	6.14	3.14	1.53	1.28	2.15	1.34	1.02	2.18	0.74	1.22	0.38
23COH	3.95	5.61	5.19	5.82	5.14	4.00	3.90	10.60	2.60	0.06	0.53	0.46	0.58	0.70	0.61	0.61	4.97	0.07
24SDR		3.73	3.76	3.38	3.49	2.75	2.97	3.68	1.31		0.13	0.18	0.04	0.38	0.19	0.22	0.28	0.06
24SOH		10.95	9.20	6.33	9.82	8.22	7.49	8.80	2.47		3.84	3.17	1.27	4.27	2.85	2.04	4.04	0.81
25COD	10.67	10.93	10.19	10.33	9.33	7.63	8.11	4.67	1.70	7.37	7.68	7.00	6.99	6.61	5.26	5.66	2.10	0.39
25COF	11.52	11.52	5.58	4.73	4.58	3.96	4.18	6.72	2.44	4.11	4.53	0.71	0.13	1.63	0.75	1.01	1.29	0.30
25SRD	10.63	10.93	10.19	10.33	9.33	5.91	8.11	4.52	1.93	5.50	5.99	5.08	5.36	5.76	2.39	4.63	0.84	0.36
25SRF	11.41	11.24	5.58	4.73	4.57	3.96	4.23	6.11	2.34	4.13	4.62	0.71	0.13	1.62	0.75	1.07	1.13	0.07
28BSE						5.87	5.71								0.21	0.83		
28BSO								8.81									3.47	
28BSU			10.90	7.70	3.69							5.56	2.36	0.29				
28CSE						5.87	5.71								0.21	0.83		
28CSN									8.81									0.16
28CSR								8.81									3.47	
28CSU			10.90	7.70	3.69							5.56	2.36	0.40				
28GOE						8.72	11.41	8.32							2.42	5.27	3.04	
28GOR			10.96	7.87	6.70							5.41	2.30	2.02				
28WAC			10.96	7.87	6.70							5.41	2.30	2.02				
28WOE						9.65	10.08								3.20	3.39		
29S4A	4.57	3.85	3.60	4.80	3.50	5.94	7.75	6.88	2.29	0.45	0.26	0.22	0.07	0.39	0.62	1.87	1.61	0.00
29S4B	2.73	2.30	2.15	2.87	2.09	3.55	4.63	6.88	1.35	0.20	0.11	0.11	0.00	0.10	0.04	0.14	1.61	0.00
29SU1	5.10	4.38	4.44	3.38	4.07	7.03	8.00	6.88	2.44	0.61	0.23	0.35	0.02	0.54	0.87	2.03	1.68	0.14
29SU2	4.07	3.44	3.39	4.29	3.12	5.31	9.74	6.08	2.05	0.43	0.21	0.18	0.05	0.31	0.59	3.84	1.47	0.10
29SU3	5.52	4.74	4.82	3.66	4.41	7.62	8.07	5.00	2.41	0.74	0.24	0.41	0.03	0.65	1.35	2.07	0.68	0.21
30SUL				8.88	5.14	7.90	8.97	8.59	3.13				2.00	0.69	0.92	1.58	1.90	0.25
31CUR					7.52									2.87				
31GOR					6.50									1.91				
31GOR						3.48	3.60	3.97	2.14						0.16	0.13	0.27	0.22
31SUL					7.39									2.61				
31SUN						3.06	5.07	5.40	2.03						0.05	0.46	0.70	0.16
32CAR					6.65	8.42	8.26	9.08	2.84					2.12	3.38	4.23	3.86	0.00
32CRA					5.98	4.97	4.47	4.97	2.83					1.69	0.34	0.88	0.54	0.82
32CRU					5.98	4.97	4.47	4.97	2.83					1.69	0.34	0.88	0.54	0.82
32CSC					5.98	4.97	4.47	4.97	2.83					1.69	0.34	0.88	0.54	0.82
32SMU					7.95	8.42	8.26	8.97	3.25					2.63	3.87	4.66	4.22	0.09
32SUL					6.65	8.42	8.26	8.97	3.06					2.12	3.38	4.24	3.74	0.00
33GOR					4.65	4.25	3.90	4.07	1.65					0.23	0.30	0.10	0.42	0.17
33SUL					4.75	4.25	3.90	4.07	1.65					0.24	0.23	0.09	0.42	0.14
34CAA					6.50	8.67	6.64	5.64	1.89					2.21	4.57	1.58	0.64	0.00
34CAB					4.45	2.10	2.50	5.32	2.11					0.34	0.00	0.30	0.68	0.06
34SSB							3.36	4.53	2.06							0.17	0.38	0.06
34SUA					6.50	9.32	5.29	5.37	1.95					2.21	4.53	1.27	0.54	0.00
34SUB					4.49	2.54								1.16	0.00			
35SNO					4.25									0.73				
36CAP							10.52	9.84	4.39							4.29	3.18	1.06
36CAR							10.52	9.84	4.30							4.29	3.18	0.87
36SUL					6.53	11.33	10.38	9.55	3.70					2.23	4.13	4.08	3.00	0.52
36SUN					9.08	13.65	12.95	12.15	5.12					3.92	6.52	5.87	5.37	1.03
37CAR					6.26	7.72	5.78	8.09	2.76					2.81	3.97	1.21	2.61	0.31
37SUN						7.39	5.90	7.12	2.76						3.59	1.22	1.76	0.31
39SU7						6.15									1.39			
39SU7							5.93	6.90								0.48	0.97	
39SUD									2.29									0.28
39SUJ						9.56	10.25	12.30	4.65						4.68	6.02	6.93	2.33
39SUS					7.62									2.35				
40SUE						9.34	11.37	10.59	2.64						5.08	6.60	6.34	1.71
40SUL					8.26									4.06				
41SFF							8.63	6.07	0.39							4.70	2.20	0.00
42SAC								3.78	1.08								0.68	0.06
42SEG								3.78	1.25								0.68	0.06
42SUB								3.78	1.29								0.68	0.06
42SUD								3.78	1.29								0.68	0.06
42SUN								3.78	1.13								0.68	0.06
43GOR								5.56	3.73								0.89	0.26
43SUL								5.97	3.66								1.56	0.26
43SUN								6.04	4.25								1.50	0.64
44SUL								9.96	3.50								4.60	0.43
45SUL									2.47									0.22
45SUN									4.54									0.36

Site	Cost of excess ($)									Yield (t/ha)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
01AST	199	228	321	34	137	484	202	212	54	4.40	8.00	7.75	7.46	0.65	2.09	7.41	4.94	
01CAR									5									6.07
01SUN									59									4.94
02PAA	146	102	276	63	198	134				3.75	7.50	8.40	9.14	8.64	4.94			
02PAA							7									9.16		
02PAJ	62	47	56	86	105	71				3.75	7.50	8.70	7.91	7.41	7.41			
02PAJ							3	22	8							11.04	3.67	3.15
02PAK	254	82	296	200	244	165				3.75	7.50	7.50	7.91	7.41	7.41			
02PAK							2	51	20							9.16	4.82	2.41
02PAM									12									5.09
02PQR									52									3.18
03ASR							212	141								7.41	4.94	0.81
03ASU	73	35	355	55	305	26				5.70	11.50	11.50	6.25	2.50	1.78			
04CAR									170									
04SSO									63									1.55
04SU1							1414	456								7.30	2.19	
04SU2							215	307	9							6.50	2.84	0.63
04SUN									98									
04SUO							350	509	164							5.50	1.89	0.95
04SUS									241									2.63
05PAB	168	145	361	286						8.10	0.50	4.25	2.19					
05PAG	49	57	149	148						7.50	10.80	4.25	2.19					
05PDF	100	94	266	235						11.25	11.30	4.25	2.19					
06GOR	58	8	0	2	72	164	123	43	55	6.25	8.25	5.80	8.25	6.48	6.88	7.50	10.00	5.00
06SLL						478	351	104	93						2.78	5.25	3.08	0.55
06SUL	39	71	0	44	268					5.50	3.30	7.50	6.96	4.30				
07ASD	2058	661	1586	1137	605	1079	1995	1106	160	3.11	6.53	5.70	4.96	4.57	2.16	4.88	1.12	0.60
07BSU			521	576	354	598	1428	1796	556			8.90	9.01	8.64	2.75	9.13	8.18	3.22
07CAH						980									0.40			
07CAN							2400	2029	538							4.85	1.80	3.69
07CAR			38	214	169								6.92	4.27				
07DCA			338	11	89							10.00		1.14				
07ECZ			121	212	95							5.88	7.59	2.06				
07FSL			6203	599	1449	4703						5.40		4.47	1.65			
07FWC			49	83	38							5.88	5.00	3.23				
07NSL							4932	4935	1174							7.59	3.66	2.13
07SLL			183	4192	427	259							6.07	2.20	1.16			
08ASA	219	540	648	531	160	183	222	647	52	4.95	7.00	7.50	6.49	6.20	4.74	5.46	5.56	3.39
08CAR	166	411	443	345	170	178	159	545	71	1.79	6.75	5.95	6.36	3.92	1.36	4.65	4.31	3.53
10GOF		30	24	49	76	2	48	24	21		7.50	8.10	10.83	7.48	2.90	8.60	6.03	4.56
10S32	12	9	22	6	21	29	14	9	14	7.50	7.50	7.50	6.72	1.26	4.12	7.41	3.84	1.21
10SF2				1413	1047								6.25	1.34				
10SSM	11	9	23	6	21	21	13	16	13	6.90	8.50	6.25	4.40	2.62	4.82	4.94	5.26	4.35
10SSS									11									3.02
10SUF		237	198								5.00	3.75						
11CRL	993	2845	4033	2023	0					8.60	4.38	8.30	7.14	5.80				
11CRO		94	179	41	33						2.50	8.00	8.95	5.80				
13SOR	209	417	1240							5.00	3.80	8.25						
14ACA	202	124	166	195	101	772	842	699	61	7.40	10.27	13.50	15.60	11.54	5.93	12.29	6.55	6.30
14BSU	365	239	262	399	212	1567	633	551	94	6.25	10.44	9.80	7.02	7.90	6.67	8.42	7.04	5.81
15ASR	3	12	63	54						4.17	11.68	9.00	9.13					
15BSP	2	10	39	34						3.30	10.00	6.30	6.74					
16SNS	654	557	802	745	209	0	443	430	262	7.50	13.00	12.00	10.92	10.00	8.54	12.50	5.61	3.75
17GSR	250	100	302	146	918					7.50	8.10	6.40	8.65	6.21				
17H5S	90	0	111							6.50	6.80	5.20						
17OST	8	15	34	20						6.00	5.61	4.42	8.13					
18AST	96	160	50	12						7.00	5.00	8.25	5.56					
19ASM	295									2.50								
19ASM		4	53	12	251	72					4.70	4.63	4.77	4.68	5.26			
20S32	33	67	179	280	305	177				9.20	12.59	11.40	7.45	9.64	5.66			
20S36	30	61	165	49	167	135				9.20	12.59	11.40	7.45	9.64	5.66			
20SM1							679	653	56							5.67	7.53	5.31
20SM3							791	537	70							5.67	7.53	5.31
21AST	167	73	259	82	204					1.20	7.00	6.25	4.90	4.20				
21HO8						14	116	41	0						5.59	7.23	5.39	5.70
22SUL	156	184								7.50	7.50							
22SUL			26									7.50						

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Site	Cost of excess ($)									Yield (t/ha)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	100	88	150	98	19	254	96	26	6	3.97	5.86	5.13	7.43	4.66	1.97	2.34	3.11	3.85
23COH	6	54	48	63	20	147	136	154	2	4.15	6.42	6.41	8.14	3.47	2.64	4.68	2.43	3.15
24SDR		5	6	1	13	6	70	41	3		9.50	5.70	8.55	6.10	5.19	6.96	3.96	2.24
24SOH		254	212	87	291	194	606	659	75		6.60	9.10	7.52	5.22	6.35	5.35	5.11	2.80
25COD	471	497	452	452	427	340	380	141	29	2.39	2.49	3.30	3.44	1.24	1.35	3.19	1.21	0.28
25COF	42	36	51	9	118	106	76	68	17	2.39	2.49	3.30	3.44	1.48	0.60	0.53	1.19	0.22
25SRD	505	557	472	498	535	286	447	81	37	2.57	5.93	5.20	4.11	5.95	2.80	5.08	2.97	0.48
25SRF	166	141	182	33	418	194	286	303	19	2.57	5.93	5.20	4.11	3.11	3.08	6.48	2.15	0.36
28BSE						24	170								3.97	4.00		
28BSO								166									3.24	
28BSU			497	147	18							6.17	6.12	11.17				
28CSE						36	259								6.57	8.93		
28CSN									73									3.97
28CSR								530									5.21	
28CSU			155	46	11							11.12	13.17	6.37				
28GOE						52	246	290							5.90	3.53	5.81	
28GOR			398	138	151							7.45	12.50	8.85				
28WAC			297	92	46							4.65	10.48	7.14				
28WOE						60	383								7.14	4.00		
29S4A	12	7	6	2	11	108	264	451	0	6.16	8.99	7.51	6.23	2.15	5.85	6.70	5.36	2.94
29S4B	10	6	6	0	6	20	61	888	0	6.16	8.99	7.51	6.23	2.63	5.94	6.70	5.36	1.47
29SU1	48	19	29	2	47	390	832	1405	15	2.67	4.27	4.66	2.87	6.16	1.18	2.35	4.89	2.83
29SU2	34	17	15	4	27	334	1354	1369	11	6.22	8.99	7.51	6.23	4.70	1.65	7.99	5.36	0.99
29SU3	58	20	34	2	56	570	829	756	19		7.71	7.51	6.23	4.50	1.65	7.58	5.36	0.99
30SUL				583	202	365	1249	1335	83				11.30	11.35	7.33	11.82	7.10	4.81
31CUR					106									1.50				
31GOR					69									1.60				
31GOR						13	17	31	9						2.22	1.74	5.27	1.78
31SUL					378									1.90				
31SUN						8	83	115	12						5.12	5.47	7.54	2.87
32CAR					143	228	423	272	0					5.46	3.83	7.82	4.49	2.80
32CRA					147	30	142	50	81						2.12	5.36	4.34	1.34
32CRU					362	74	349	122	199					0.45	2.04	4.06	2.97	0.76
32CSC					214	44	207	72	118					4.07	2.27	3.58	3.39	2.56
32SMU					380	559	997	637	14					4.41	5.43	2.95	3.53	2.31
32SUL					101	161	299	187	0					7.85	2.74	6.56	3.43	1.20
33GOR					4	61	61	84	4					11.48	2.50	12.84	4.57	5.98
33SUL					5	47	54	83	3					8.28	3.00	9.64	1.23	3.52
34CAA					77	0	37	26	0					4.59		5.64	2.43	4.24
34CAB					18	0	17	38	4					4.59			2.43	2.83
34SSB							15	32	5							3.07	4.02	
34SUA					524	0	307	130	0					4.34	3.11	3.07	2.63	
34SUB					230	0								4.34	3.11			
35SNO					14									3.20				
36CAP							413	451	49							8.90	5.26	0.84
36CAR							448	417	37							8.90	5.26	0.84
36SUL					212	969	607	617	34					10.17	6.92	14.58	7.19	1.08
36SUN					318	1509	1116	1361	99					8.41	6.41	7.76	7.69	1.25
37CAR					566	522	61	358	47					5.87	6.12	8.37	2.33	6.47
37SUN						885	313	456	88						6.04	8.08	2.87	5.38
39SU7						314									1.85			
39SU7							238	194								8.03	3.61	
39SUD									217									1.00
39SUJ						72	610	20	267						6.17	8.03	3.61	1.20
39SUS					1080									5.40				
40SUE						495	917	775	277						3.00	5.75	2.43	
40SUL					912									7.42				
41SFF							907	413	0							7.50	4.00	
42SAC								61	6								0.31	
42SEG								124	10								0.31	
42SUB								75	7								0.31	
42SUD								68	6								0.31	
42SUN								44	4								2.53	0.79
43GOR								280	87								10.11	2.54
43SUL								894	160								3.85	2.47
43SUN								235	109								5.86	3.77
44SUL								841	85								3.97	3.61
45SUL									51									0.70
45SUN									56									0.71

Site	Number of irrigations									Days below refill								
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
01AST	19	22	21	14	18	15	17	17	10	263	218	237	189	198	196	247	233	190
01CAR									9									191
01SUN									10									190
02PAA	18	16	19	23	28	19				254	187	218	118	184	238			
02PAA							64									242		
02PAJ	18	16	16	25	29	25				254	190	225	108	184	236			
02PAJ							67	67	25							246	225	240
02PAK	18	16	19	25	29	25				253	187	218	108	184	236			
02PAK							66	67	25							246	225	240
02PAM									25									240
02PQR									25									237
03ASR							19	17								249	238	230
03ASU	15	15	19	8	18	19				219	184	180	186	199	237			
04CAR									11									227
04SSO									7									233
04SU1							23	19								251	236	
04SU2							21	20	8							254	239	234
04SUN									9									229
04SUO							21	20	9							253	238	234
04SUS									9									236
05PAB	63	66	65	31						194	218	191	197					
05PAG	62	66	62	31						197	226	197	197					
05PDF	61	63	68	31						196	223	187	197					
06GOR	29	27	47	50	46	63	64	42	21	254	176	223	225	191	178	193	230	213
06SLL						63	64	42	21						178	197	233	218
06SUL	27	26	47	51	43					151	152	223	225	192				
07ASD	148	152	155	144	127	126	128	73	22	111	168	131	148	194	230	201	233	233
07BSU			19	19	19	18	28	25	13			188	193	206	243	250	224	235
07CAH						22									241			
07CAN							28	23	13							255	251	232
07CAR			17	16	14							257	237	206				
07DCA			17	16	15							190	237	103				
07ECZ			14	19	14							192	231	206				
07FSL			21	20	16	22						189	232	207	241			
07FWC			17	22	16							190	151	146				
07NSL							31	23	13							255	250	234
07SLL			21	20	16	10						196	231	206	247			
08ASA	18	23	19	18	17	19	27	27	8	254	219	200	285	192	235	247	222	224
08CAR	17	22	19	20	18	17	27	27	7	245	220	199	226	194	237	249	223	232
10GOF		22	27	37	31	15	33	26	11		186	167	222	187	261	254	231	250
10S32	41	49	90	62	60	53	30	58	40	251	241	192	227	189	245	241	230	233
10SF2				37	31								213	184				
10SSM	41	49	93	62	60	46	30	59	41	257	241	191	227	189	248	241	229	233
10SSS									40									234
10SUF		22	27								186	167						
11CRL	19	19	21	16	10					231	227	219	214	128				
11CRO		20	19	18	11						240	225	223	131				
13SOR	43	55	127							200	186	165						
14ACA	57	56	66	64	60	52	56	57	28	241	207	223	201	221	241	237	225	234
14BSU	57	55	67	64	60	52	56	57	28	240	204	231	197	214	238	237	224	233
15ASR	56	136	162	135						116	188	224	203					
15BSP	57	137	162	136						116	189	224	203					
16SNS	17	17	19	15	13	8	14	12	7	222	246	223	238	194	200	261	261	224
17GSR	10	9	14	9	10					166	150	169	201	153				
17H5S	10	9	14							164	158	178						
17OST	10	9	14	9						163	158	178	209					
18AST	20	27	11	14						262	238	215	184					
19ASM	20									261								
19ASM		70	116	138	111	82					223	231	223	230	246			
20S32	26	20	37	29	23	36				185	175	205	218	186	240			
20S36	26	20	38	21	20	34				185	175	205	226	198	232			
20SM1							30	27	10							214	214	222
20SM3							28	23	10							216	218	222
21AST	38	48	50	43	37					264	219	228	197	234				
21HO8						47	58	49	25						238	230	233	228
22SUL	26	26								180	182							
22SUL			32									223						

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Site	Number of irrigations									Days below refill								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	12	12	15	11	10	8	8	15	7	206	167	199	209	159	236	234	229	218
23COH	10	13	13	13	11	9	8	17	7	214	188	208	213	204	209	238	218	220
24SDR		43	50	39	45	39	37	45	14		219	235	213	194	242	243	233	246
24SOH		24	24	16	21	20	17	19	6		215	226	126	248	229	244	217	248
25COD	23	22	23	30	29	26	29	34	19	176	162	180	176	147	174	211	196	213
25COF	23	20	23	30	29	26	27	34	5	194	181	199	205	165	196	257	244	235
25SRD	23	22	23	30	29	26	29	33	7	176	164	180	180	151	182	224	217	225
25SRF	23	20	25	30	29	26	28	33	5	194	181	198	205	165	196	257	249	236
28BSE						12	12								242	269		
28BSO								18									259	
28BSU			18	14	8							185	134	162				
28CSE						12	12								242	269		
28CSN									20									218
28CSR								18									259	
28CSU			18	14	8							185	196	161				
28GOE						11	12	18							242	268	259	
28GOR			10	8	8							190	198	160				
28WAC			10	8	8							190	198	160				
28WOE						11	13								238	260		
29S4A	18	18	16	18	17	16	12	15	4	263	217	244	198	210	234	253	262	242
29S4B	18	18	16	18	17	16	12	15	4	264	218	269	198	210	241	256	262	243
29SU1	18	18	17	18	17	17	14	15	4	261	217	243	198	209	233	241	234	194
29SU2	18	18	17	18	17	16	14	14	4	261	217	245	198	210	234	238	234	240
29SU3	18	18	17	18	17	17	13	14	4	260	215	243	198	208	230	240	237	239
30SUL				80	113	130	151	165	83				197	228	220	181	185	216
31CUR					9									201				
31GOR					8									202				
31GOR						33	51	53	21						236	238	229	213
31SUL					9									201				
31SUN						35	54	55	22						235	232	223	219
32CAR					12	11	11	12	13					183	232	251	216	221
32CRA					12	12	9	14	8					161	233	249	223	216
32CRU					12	12	9	14	8					161	233	249	223	216
32CSC					12	12	9	14	8					161	233	249	224	216
32SMU					16	11	11	12	13					181	204	248	217	216
32SUL					12	11	11	12	13					182	232	251	216	222
33GOR					61	47	51	57	35					223	196	233	233	218
33SUL					62	47	51	57	35					164	198	234	235	221
34CAA					12	9	12	16	5					172	231	248	229	223
34CAB					12	10	11	17	5					173	231	267	229	222
34SSB							11	16	5							267	228	222
34SUA					12	11	13	21	5					172	231	250	227	223
34SUB					12	12								173	231			
35SNO					10									218				
36CAP							20	22	10							237	232	246
36CAR							20	22	10							237	231	247
36SUL					12	18	19	20	9					141	229	226	236	253
36SUN					14	18	21	22	10					148	227	225	228	246
37CAR					53	49	72	65	32					200	191	184	188	211
37SUN						51	71	66	32						193	183	197	211
39SU7						12									253			
39SU7							55	55								226	209	
39SUD									17									236
39SUJ						7	8	33	6						257	248	232	249
39SUS					15									180				
40SUE						9	10	9	2						233	248	221	192
40SUL					9									122				
41SFF							9	9	1							261	239	237
42SAC								22	8								235	222
42SEG								22	8								232	222
42SUB								22	8								235	222
42SUD								22	8								231	222
42SUN								22	8								232	222
43GOR								21	20								229	215
43SUL								23	21								224	244
43SUN								23	24								223	239
44SUL								18	7								228	232
45SUL									30									185
45SUN									17									184

Site	Cost of water ($/ML)									Crop production per megalitre (t/ML)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
01AST	80	81	81	81	81	535	85	85	85	0.67	1.09	1.16	1.55	0.12	0.42	1.18	0.82	
01CAR									85									3.19
01SUN									85									2.47
02PAA	92	95	97	102	102	102				0.54	1.13	1.01	1.42	1.15	0.71			
02PAA							107									2.13		
02PAJ	92	95	97	102	102	102				0.54	1.13	1.27	1.08	0.95	0.87			
02PAJ							107	162	115							2.46	0.67	1.76
02PAK	92	95	97	102	102	102				0.54	1.13	0.90	1.08	0.95	0.87			
02PAK							107	162	115							2.05	0.87	1.35
02PAM									115									2.85
02PQR									115									1.68
03ASR							110	84								1.16	0.79	
03ASU	70	74	76	79	79	79				1.47	2.85	1.45	2.02	0.35	0.36			
04CAR									132									
04SSO									132									0.73
04SU1							277	171								1.02	0.37	
04SU2							256	176	132							1.10	0.52	0.31
04SUN									132									
04SUO							256	180	132							0.93	0.37	0.39
04SUS									132									0.96
05PAB	39	40	40	50						0.86	0.06	0.41	0.36					
05PAG	35	47	41	56						0.93	1.60	0.47	0.41					
05PDF	40	42	41	53						1.35	1.67	0.44	0.39					
06GOR	42	42	42	42	42	42	44	44	50	2.26	2.97	1.74	2.21	1.51	1.61	1.97	2.85	2.24
06SLL						42	44	44	50						0.65	1.38	0.86	0.25
06SUL	42	42	42	42	42					2.21	1.13	2.43	1.82	0.98				
07ASD	80	81	81	81	81	170	177	178	90	0.27	0.73	0.63	0.55	0.82	0.31	0.64	0.21	0.36
07BSU			78	78	79	162	162	131	90			1.05	0.97	1.24	0.36	0.99	0.77	0.75
07CAH						150									0.04			
07CAN							165	136	90							0.55	0.19	0.84
07CAR				101	81								1.00	0.81				
07DCA			300		81							1.35		0.21				
07ECZ			80	80	81							0.96	0.90	0.41				
07FSL			135		81	148						0.60		0.74	0.18			
07FWC			81	81	80							0.75	0.52	0.52				
07NSL							166	139	90							0.83	0.38	0.51
07SLL				369	81	230							0.70	0.37	0.28			
08ASA	80	81	81	86	81	81	84	84	90	0.66	0.69	0.72	0.76	0.91	0.67	0.76	0.57	0.92
08CAR	80	81	81	81	81	89	84	84	90	0.24	0.68	0.57	0.74	0.57	0.19	0.65	0.44	1.08
10GOF		95	97	102	102	102	107	107	115		1.47	1.96	1.70	1.33	0.97	1.26	1.48	2.87
10S32	92	95	97	102	102	73	107	107	115	2.17	1.88	1.32	1.58	0.30	0.70	2.26	1.13	0.48
10SF2				102	102								0.73	0.18				
10SSM	92	95	97	102	102	102	107	107	115	2.00	2.13	1.10	1.04	0.62	0.95	1.52	1.44	1.69
10SSS									115									1.25
10SUF		95	102								0.98	0.91						
11CRL	92	95	97	102	102					1.45	0.39	0.70	0.78	3.99				
11CRO		95	97	102	102						0.38	1.11	1.49	1.79				
13SOR	80	81	81							1.48	0.78	1.02						
14ACA	73	76	97	81	81	477	860	322	115	1.10	1.34	2.01	2.01	1.71	0.92	1.96	1.06	2.00
14BSU	101	105	107	113	112	647	486	177	115	0.92	1.41	1.46	0.91	1.17	1.04	1.35	1.14	1.84
15ASR	70	74	76	79						1.10	1.90	1.44	1.26					
15BSP	70	74	76	79						0.87	1.63	1.01	0.92					
16SNS	80	81	81	81	81	143	84	84	90	0.83	1.60	1.26	1.20	1.63	2.12	1.69	0.82	0.97
17GSR	80	81	81	81	81					1.18	1.25	0.99	1.60	0.88				
17H5S	80	81	81							1.02	1.05	0.80						
17OST	80	336	81	81						0.92	0.72	0.68	1.50					
18AST	111	116	118	122						1.14	0.67	2.00	1.28					
19ASM	92									0.55								
19ASM		95	97	102	102	102					0.98	0.99	1.03	0.77	1.17			
20S32	80	81	81	81	81	81				1.41	2.11	1.30	0.73	0.96	0.61			
20S36	80	81	81	81	81	81				1.41	2.11	1.26	1.12	1.14	0.66			
20SM1							84	84	90							0.50	0.76	1.60
20SM3							84	84	90							0.55	0.91	1.60
21AST	61	50	59	72	72					0.29	1.40	1.38	1.21	1.03				
21HO8						42	44	44	50						1.21	1.26	0.93	1.86
22SUL	10	12								0.75	0.75							
22SUL			13									1.42						

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Site	Cost of water ($/ML)									Crop production per megalitre (t/ML)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	70	74	76	79	13	134	148	16	18	0.68	0.90	0.65	1.19	0.85	0.34	0.50	0.51	1.23
23COH	70	74	76	79	13	188	174	15	15	1.05	1.14	1.23	1.40	0.67	0.66	1.20	0.23	1.21
24SDR		12	13	13	13	13	248	103	18		2.54	1.51	2.53	1.75	1.89	2.34	1.08	1.71
24SOH		12	13	13	13	13	109	51	18		0.60	0.99	1.19	0.53	0.77	0.71	0.58	1.13
25COD	80	81	81	81	81	81	84	84	90	0.22	0.23	0.32	0.33	0.13	0.18	0.39	0.26	0.17
25COF	72	72	81	81	81	156	84	58	63	0.21	0.22	0.59	0.73	0.32	0.15	0.13	0.18	0.09
25SRD	80	81	81	81	81	104	84	84	90	0.24	0.54	0.51	0.40	0.64	0.47	0.63	0.66	0.25
25SRF	81	81	81	81	81	81	84	84	90	0.23	0.53	0.93	0.87	0.68	0.78	1.53	0.35	0.15
28BSE						173	198								0.88	0.91		
28BSO								89									0.48	
28BSU			84	84	84							0.71	1.03	3.93				
28CSE						173	198								1.45	2.03		
28CSN									90									1.43
28CSR								89									0.77	
28CSU			81	81	138							1.28	2.22	2.24				
28GOE						192	186	89							1.57	0.72	0.91	
28GOR			104	121	131							0.85	2.06	1.71				
28WAC			84	87	43							0.53	1.73	1.38				
28WOE						148	293								1.16	0.51		
29S4A	70	74	76	79	79	504	408	817	90	1.35	2.33	2.09	1.30	0.61	0.98	0.86	0.78	1.28
29S4B	70	74	76	79	79	791	627	817	90	2.26	3.91	3.50	2.17	1.26	1.67	1.45	0.78	1.09
29SU1	70	74	76	79	79	439	398	817	90	0.52	0.98	1.05	0.85	1.51	0.17	0.29	0.71	1.16
29SU2	70	74	76	79	79	556	342	915	90	1.53	2.61	2.22	1.45	1.51	0.31	0.82	0.88	0.48
29SU3	70	74	76	79	79	411	390	1095	90		1.63	1.56	1.70	1.02	0.22	0.94	1.07	0.41
30SUL				81	81	116	247	216	90				1.27	2.21	0.93	1.32	0.83	1.54
31CUR					31									0.20				
31GOR					81									0.25				
31GOR						189	311	276	90						0.64	0.48	1.33	0.83
31SUL					81									0.26				
31SUN						204	245	225	90						1.67	1.08	1.40	1.42
32CAR					79	79	118	83	90					0.82	0.45	0.95	0.49	0.99
32CRA					79	79	147	83	90						0.43	1.20	0.87	0.47
32CRU					79	79	147	83	90					0.08	0.41	0.91	0.60	0.27
32CSC					79	79	147	83	90					0.68	0.46	0.80	0.68	0.90
32SMU					79	79	118	83	90					0.55	0.64	0.36	0.39	0.71
32SUL					79	79	117	83	90					1.18	0.33	0.79	0.38	0.39
33GOR					13	139	396	135	18					2.47	0.59	3.29	1.12	3.63
33SUL					14	147	413	140	18					1.74	0.71	2.47	0.30	2.14
34CAA					71	71	82	84	90					0.71		0.85	0.43	2.25
34CAB					81	81	84	84	90					1.03			0.46	1.34
34SSB							84	84	90							0.91	0.89	
34SUA					82	82	84	84	90					0.67	0.33	0.58	0.49	
34SUB					81	81								0.97	1.22			
35SNO					13									0.75				
36CAP							103	152	50							0.85	0.53	0.19
36CAR							121	152	50							0.85	0.53	0.20
36SUL					55	137	87	120	38					1.56	0.61	1.41	0.75	0.29
36SUN					36	120	99	132	50					0.93	0.47	0.60	0.63	0.24
37CAR					72	42	8	44	50					0.94	0.79	1.45	0.29	2.35
37SUN						42	44	44	50						0.82	1.37	0.40	1.95
39SU7						102									0.30			
39SU7							238	88								1.35	0.52	
39SUD									115									0.44
39SUJ						102	179	107	114						0.65	0.78	0.29	0.26
39SUS					86									0.71				
40SUE						79	89	83	90						0.32	0.51	0.23	
40SUL					79									0.90				
41SFF							151	84	90							0.87	0.66	
42SAC								83	90								0.08	
42SEG								83	81								0.08	
42SUB								83	90								0.08	
42SUD								83	90								0.08	
42SUN								83	90								0.67	0.70
43GOR								107	115								1.82	0.68
43SUL								107	115								0.65	0.68
43SUN								107	114								0.97	0.89
44SUL								107	115								0.40	1.03
45SUL									18									0.28
45SUN									18									0.16

Site	Gross return per megalitre ($/ML)									Cost of water per tonne of fruit ($/t)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
01AST	956	1615	1630	1801	162	675	2027	1387		131	81	76	57	719	1285	78	113	
01CAR									6160									29
01SUN									4380									38
02PAA	777	1672	1317	1552	1354	1278				186	92	105	78	97	156			
02PAA							4173									53		
02PAJ	777	1672	1777	1178	1097	1571				186	92	84	103	116	127			
02PAJ							4812	1232	3095							46	254	70
02PAK	777	1672	1279	1178	1097	1571				186	92	118	103	116	127			
02PAK							4013	1529	2372							55	193	91
02PAM									5057									43
02PQR									3074									74
03ASR							1973	1259								103	120	74
03ASU	2016	4238	1890	2428	464	618				54	29	58	44	249	242			
04CAR																		
04SSO									1031									182
04SU1							1802	627								272	463	
04SU2							1939	793	480							233	336	426
04SUN																		
04SUO							1641	642	609							275	481	340
04SUS									1480									137
05PAB	1241	95	577	451						48	664	103	145					
05PAG	1330	2382	659	516						39	31	94	143					
05PDF	1934	2482	619	492						30	27	98	143					
06GOR	3245	4414	2432	2510	1817	2905	2759	4853	2941	24	18	31	24	36	33	28	20	29
06SLL						1186	2207	1505	432						82	41	66	260
06SUL	2889	1537	3404	2047	1176					23	44	22	30	55				
07ASD	389	1085	880	704	1046	502	1153	366	457	318	119	139	158	106	595	311	947	327
07BSU			1477	1152	1591	624	1731	1361	1220			89	97	76	498	185	200	155
07CAH						70									3729			
07CAN							1041	357	1399							339	841	138
07CAR				1351	1086								117	119				
07DCA			2435		282							234		457				
07ECZ			1350	1155	545							100	106	237				
07FSL			841		997	276						252		130	924			
07FWC			1050	863	866							129	188	184				
07NSL							1413	634	654							227	424	228
07SLL				806	450	486							549	264	886			
08ASA	953	1026	1009	804	1032	1065	1470	803	1676	132	128	123	124	97	133	121	161	108
08CAR	443	1257	1026	957	745	301	1232	800	2054	362	131	156	121	155	504	142	208	92
10GOF		2055	2747	2850	2268	1790	2464	2884	5395		65	50	60	76	105	85	72	40
10S32	3118	2785	1844	2060	422	1219	3962	1976	859	46	55	80	70	369	117	51	103	260
10SF2				946	250								140	575				
10SSM	2869	3156	1537	1349	818	1784	2651	2520	3001	50	49	96	107	178	116	76	81	75
10SSS									2221									100
10SUF		1404	1272								97	112						
11CRL	2649	718	1257	1015	5388					68	263	150	140	27				
11CRO		707	2000	1939	2417						267	94	73	61				
13SOR	2129	1164	1422							60	115	85						
14ACA	2014	2454	3623	2717	2305	1479	3690	2012	3653	78	66	52	44	52	524	443	311	62
14BSU	1316	2091	2046	1177	1590	1903	2508	2162	3228	124	83	78	132	102	630	366	162	68
15ASR	1573	2818	2014	1366						74	45	60	71					
15BSP	1192	2420	1411	1010						93	52	86	98					
16SNS	1096	2428	1770	1380	2045	3810	3130	1438	1747	113	59	74	77	57	73	57	119	108
17GSR	1688	1856	1417	1760	1082					68	65	82	51	92				
17H5S	1463	1558	1151							78	77	101						
17OST	1320	1070	979	1655						87	87	119	54					
18AST	1631	996	2801	1407						112	198	68	109					
19ASM	754									183								
19ASM		1451	1387	1230	961	1936					106	107	108	144	95			
20S32	1375	2214	1815	839	1137	996				77	52	82	146	111	174			
20S36	1375	2214	1765	1287	1347	1068				77	52	85	95	94	163			
20SM1							888	1489	2624							218	142	73
20SM3							968	1771	2624							200	119	73
21AST	414	2079	1869	1552	1350					264	46	56	77	91				
21HO8						2122	2424	1683	3284						52	52	71	40
22SUL	1053	1053								30	34							
22SUL			2036									18						

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Site	Gross return per megalitre ($/ML)									Cost of water per tonne of fruit ($/t)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	1235	1656	1167	1611	1111	545	954	912	2246	119	94	133	75	28	425	314	53	15
23COH	1917	2117	2222	1888	877	1063	2270	413	2219	77	74	70	64	35	301	154	112	23
24SDR		3779	2029	2781	2010	3086	4335	1856	2693		11	18	11	16	15	112	111	23
24SOH		895	1325	1307	611	1263	1322	1019	1840		46	28	24	53	37	173	117	34
25COD	409	422	583	433	166	277	747	467	322	356	355	249	243	608	457	214	324	541
25COF	379	410	1064	945	404	237	241	319	171	385	365	137	111	250	1028	663	330	710
25SRD	347	806	715	477	813	876	1162	1183	405	330	149	158	203	127	220	134	128	361
25SRF	323	783	1304	1042	868	1439	2842	634	248	938	153	87	93	119	104	55	239	590
28BSE						1217	1353								224	245		
28BSO								728									239	
28BSU			792	1007	3786							286	203	27				
28CSE						2015	3019								136	110		
28CSN									2336									63
28CSR								1034									149	
28CSU			1428	1908	2159							158	95	47				
28GOE						1217	583	1273							190	414	126	
28GOR			810	1807	2179							238	102	61				
28WAC			849	2165	1758							157	50	31				
28WOE						1081	766								167	570		
29S4A	1855	3324	2871	1557	786	1773	1669	1504	2085	58	35	40	67	141	519	481	1060	78
29S4B	3108	5568	4809	2607	1612	3013	2796	1504	1770	34	21	24	40	69	477	438	1060	91
29SU1	720	1391	1442	1105	1938	285	567	1208	1883	148	83	79	102	57	2655	1378	1161	87
29SU2	2099	3725	3049	1744	1927	544	1584	1501	786	51	31	37	60	58	1812	425	1046	207
29SU3		2318	2145	2045	1306	378	1598	2073	668		50	53	51	85	1934	423	1028	219
30SUL				1400	2540	1746	2221	1348	2611				76	44	143	200	284	72
31CUR					269									156				
31GOR					406									368				
31GOR						1143	944	2586	1402						312	666	216	125
31SUL					347									352				
31SUN						3098	1883	2436	2371						128	237	169	73
32CAR					1067	735	1790	935	1755					97	175	124	168	91
32CRA						688	2268	1650	843						186	122	95	190
32CRU					98	664	1718	1130	475					1056	193	162	139	337
32CSC					885	737	1515	1291	1608					117	174	183	122	100
32SMU					656	1173	625	765	1224					143	123	329	211	127
32SUL					1570	601	1430	737	670					67	244	148	217	229
33GOR					4070	1087	5428	1330	7074					5	237	120	120	5
33SUL					2881	1269	4335	444	3471					8	208	167	465	8
34CAA					953		1778	1604	4334					100		87	195	40
34CAB					1392			806	2591					78			184	67
34SSB							1577	1418								92	95	
34SUA					805	350	1001	784						123	246	145	171	
34SUB					1165	1285								84	66			
35SNO					2900									26				
36CAP							1608	1015	363							122	286	261
36CAR							1608	1015	371							143	286	256
36SUL					2073	1129	2389	1432	552					35	224	62	159	132
36SUN					1245	845	1018	1075	413					46	257	165	209	205
37CAR					1266	1240	2754	547	4459					91	70	15	202	27
37SUN						1438	2645	709	3317						68	42	144	33
39SU7						490									373			
39SU7							2303	890								183	189	
39SUD									655									296
39SUJ						1181	1332	499	387						158	229	365	441
39SUS					886									135				
40SUE						572	976	402							247	164	361	
40SUL					1231									88				
41SFF							1608	1153								174	127	
42SAC								133									1026	
42SEG								133									1026	
42SUB								133									1026	
42SUD								133									1026	
42SUN								1170	1174								124	128
43GOR								3546	1138								71	206
43SUL								1129	1001								200	208
43SUN								1405	1280								133	158
44SUL								586	1142								268	111
45SUL									344									119
45SUN									295									213

Site	Gross return per megalitre ($/ML)									Cost of water per tonne of fruit ($/t)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
01AST	956	1615	1630	1801	162	675	2027	1387		131	81	76	57	719	1285	78	113	
01CAR									6160									29
01SUN									4380									38
02PAA	777	1672	1317	1552	1354	1278				186	92	105	78	97	156			
02PAA							4173									53		
02PAJ	777	1672	1777	1178	1097	1571				186	92	84	103	116	127			
02PAJ							4812	1232	3095							46	254	70
02PAK	777	1672	1279	1178	1097	1571				186	92	118	103	116	127			
02PAK							4013	1529	2372							55	193	91
02PAM									5057									43
02PQR									3074									74
03ASR							1973	1259								103	120	74
03ASU	2016	4238	1890	2428	464	618				54	29	58	44	249	242			
04CAR																		
04SSO									1031									182
04SU1							1802	627								272	463	
04SU2							1939	793	480							233	336	426
04SUN																		
04SUO							1641	642	609							275	481	340
04SUS									1480									137
05PAB	1241	95	577	451						48	664	103	145					
05PAG	1330	2382	659	516						39	31	94	143					
05PDF	1934	2482	619	492						30	27	98	143					
06GOR	3245	4414	2432	2510	1817	2905	2759	4853	2941	24	18	31	24	36	33	28	20	29
06SLL						1186	2207	1505	432						82	41	66	260
06SUL	2889	1537	3404	2047	1176					23	44	22	30	55				
07ASD	389	1085	880	704	1046	502	1153	366	457	318	119	139	158	106	595	311	947	327
07BSU			1477	1152	1591	624	1731	1361	1220			89	97	76	498	185	200	155
07CAH						70									3729			
07CAN							1041	357	1399							339	841	138
07CAR				1351	1086								117	119				
07DCA			2435		282							234		457				
07ECZ			1350	1155	545							100	106	237				
07FSL			841		997	276						252		130	924			
07FWC			1050	863	866							129	188	184				
07NSL							1413	634	654							227	424	228
07SLL				806	450	486							549	264	886			
08ASA	953	1026	1009	804	1032	1065	1470	803	1676	132	128	123	124	97	133	121	161	108
08CAR	443	1257	1026	957	745	301	1232	800	2054	362	131	156	121	155	504	142	208	92
10GOF		2055	2747	2850	2268	1790	2464	2884	5395		65	50	60	76	105	85	72	40
10S32	3118	2785	1844	2060	422	1219	3962	1976	859	46	55	80	70	369	117	51	103	260
10SF2				946	250								140	575				
10SSM	2869	3156	1537	1349	818	1784	2651	2520	3001	50	49	96	107	178	116	76	81	75
10SSS									2221									100
10SUF		1404	1272								97	112						
11CRL	2649	718	1257	1015	5388					68	263	150	140	27				
11CRO		707	2000	1939	2417						267	94	73	61				
13SOR	2129	1164	1422							60	115	85						
14ACA	2014	2454	3623	2717	2305	1479	3690	2012	3653	78	66	52	44	52	524	443	311	62
14BSU	1316	2091	2046	1177	1590	1903	2508	2162	3228	124	83	78	132	102	630	366	162	68
15ASR	1573	2818	2014	1366						74	45	60	71					
15BSP	1192	2420	1411	1010						93	52	86	98					
16SNS	1096	2428	1770	1380	2045	3810	3130	1438	1747	113	59	74	77	57	73	57	119	108
17GSR	3352	2685	1750	3081	1082					44	57	84	37	117				
17H5S	2542	2254	1422							41	47	73						
17OST	2293	1860	1209	2896						43	60	106	54					
18AST	1631	996	2801	1407						112	198	68	109					
19ASM	754									183								
19ASM		1451	1387	1230	961	1936					106	107	108	144	95			
20S32	1375	2214	1815	839	1137	996				77	52	82	146	111	174			
20S36	1375	2214	1765	1287	1347	1068				77	52	85	95	94	163			
20SM1							888	1489	2624							218	142	73
20SM3							968	1771	2624							200	119	73
21AST	414	2079	1869	1552	1350					264	46	56	77	91				
21HO8						2122	2424	1683	3284						52	52	71	40
22SUL	1053	1053								30	34							
22SUL			2036									18						

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Site	Yield per volume of drainage (t/ML)									Cost of drainage per tonne of fruit ($/t)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	2.6	4.6	2.4	5.5	4.6	0.9	3.2	2.6	10.1	31.0	18.4	36.0	16.2	5.1	159.4	50.4	10.4	1.8
23COH	68.5	12.0	13.9	13.9	4.9	4.3	7.7	0.5	42.9	1.2	7.0	6.2	6.4	4.8	46.0	24.1	52.4	0.6
24SDR		71.3	32.0	225.7	15.9	27.2	31.2	13.9	35.0		0.4	0.9	0.1	1.8	1.0	8.4	8.6	1.1
24SOH		1.7	2.9	5.9	1.2	2.2	2.6	1.3	3.5		16.0	9.7	4.8	23.2	12.7	47.2	53.8	11.1
25COD	0.3	0.3	0.5	0.5	0.2	0.3	0.6	0.6	0.7	246.2	249.3	171.3	164.2	430.6	314.7	149.2	145.7	125.5
25COF	0.6	0.6	4.7	26.8	0.9	0.8	0.5	0.9	0.7	137.2	147.2	17.3	3.0	88.8	101.6	159.5	91.1	87.1
25SRD	0.5	1.0	1.0	0.8	1.0	1.2	1.1	3.5	1.4	170.8	81.7	79.0	105.3	78.1	88.9	76.6	23.7	66.8
25SRF	0.6	1.3	7.4	32.0	1.9	4.1	6.1	1.9	5.3	339.7	62.9	11.0	2.5	42.2	19.8	13.9	44.3	17.0
28BSE						18.8	4.8								8.1	35.6		
28BSO								0.9									94.0	
28BSU			1.1	2.6	38.9							145.5	62.3	2.1				
28CSE						31.1	10.8								4.9	16.0		
28CSN									24.9									3.6
28CSR								1.5									58.5	
28CSU			2.0	5.6	16.1							80.7	28.9	5.0				
28GOE						2.4	0.7	1.9						18.5	52.8	191.3	46.1	
28GOR			1.4	5.5	4.4							117.3	29.7	9.4				
28WAC			0.9	4.6	3.5							77.7	14.6	6.3				
28WOE						2.2	2.8								55.5	191.6		
29S4A	13.6	35.1	34.4	96	5.5	9.4	3.6	3.3		5.7	2.3	2.4	0.9	15.6	54.2	116.0	247.2	0.0
29S4B	31.2	85.1	65.4	4478	26.0	160.0	46.5	3.3		2.5	1.0	1.3	0.0	3.3	5.0	13.7	247.1	0.0
29SU1	4.4	18.4	13.5	158.5	11.5	1.4	1.2	2.9	19.6	17.8	4.4	6.1	0.5	7.5	326.7	350.5	284.2	5.1
29SU2	14.5	43.4	40.6	129.5	15.1	2.8	2.1	3.7	9.5	5.3	1.9	2.0	0.7	5.7	200.9	167.8	252.7	10.5
29SU3		31.9	18.3	227.6	7.0	1.2	3.7	7.9	4.6		2.5	4.5	0.4	12.4	342.2	108.3	139.6	19.4
30SUL				5.7	16.4	8.0	7.5	3.7	19.1				17.2	5.9	16.6	35.2	62.7	5.8
31CUR					0.5									59.4				
31GOR					0.8									108.2				
31GOR						14.1	13.4	19.6	8.0						14.1	24.0	14.6	12.9
31SUL					0.7									124.3				
31SUN						99.6	11.9	10.8	17.6						2.1	21.6	21.8	5.9
32CAR					2.6	1.1	1.9	1.2						30.9	70.1	63.6	71.2	0.0
32CRA						6.2	6.1	8.0	1.6						12.9	24.1	10.4	54.7
32CRU					0.3	6.0	4.6	5.5	0.9					297.6	13.3	31.8	15.2	97.3
32CSC					2.4	6.6	4.1	6.2	3.1					32.9	12.0	36.1	13.3	28.7
32SMU					1.7	1.4	0.6	0.8	26.2					47.4	56.6	185.7	99.0	3.4
32SUL					3.7	0.8	1.6	0.9						21.5	98.0	75.9	90.6	0.0
33GOR					49.8	8.5	122.7	10.8	35.6					0.3	16.4	3.2	12.5	0.5
33SUL					34.8	13.2	104.3	2.9	25.9					0.4	11.1	4.0	47.8	0.7
34CAA					2.1		3.6	3.8						34.2		20.6	22.2	0.0
34CAB					13.3			3.6	43.6					6.1			23.4	2.1
34SSB							17.8	10.5								4.7	8.0	
34SUA					2.0	0.7	2.4	4.9						42.0	119.6	34.7	17.2	
34SUB					3.7									21.7	0.0			
35SNO					4.4									4.4				
36CAP							2.1	1.7	0.8							49.9	92.2	63.0
36CAR							2.1	1.7	1.0							58.5	92.2	51.6
36SUL					4.6	1.7	3.6	2.4	2.1					12.1	81.5	24.2	49.9	18.5
36SUN					2.2	1.0	1.3	1.4	1.2					19.7	122.6	74.9	92.2	41.3
37CAR					2.1	1.5	6.9	0.9	20.9					40.8	36.1	3.1	65.1	3.1
37SUN						1.7	6.6	1.6	17.4						32.9	8.7	35.7	3.7
39SU7						1.3									84.1			
39SU7							16.9	3.7								14.7	26.6	
39SUD									3.6									35.7
39SUJ						1.3	1.3	0.5	0.5						77.2	134.4	205.6	220.7
39SUS					2.3									41.7				
40SUE						0.6	0.9	0.4							134.5	95.2	216.4	
40SUL					1.8									43.4				
41SFF							1.6	1.8								94.7	46.2	
42SAC								0.5									184.0	
42SEG								0.5									184.0	
42SUB								0.5									184.0	
42SUD								0.5									184.0	
42SUN								3.7	13.6								22.3	6.6
43GOR								11.3	9.9								11.4	14.1
43SUL								2.5	9.7								52.2	14.5
43SUN								3.9	5.9								33.0	23.7
44SUL								0.9	8.3								123.8	13.8
45SUL									3.1									10.7
45SUN									2.0									17.1

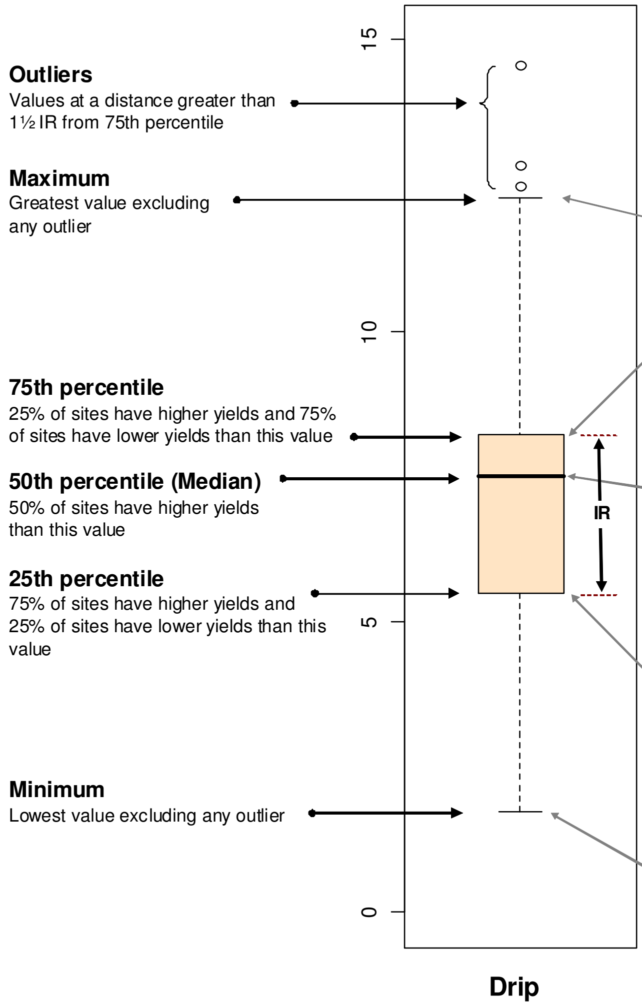
Site	Yield per volume of drainage (t/ML)									Cost of drainage per tonne of fruit ($/t)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
01AST	6.4	10.4	7.1	64.3	1.4	7.8	11.3	7.2		13.5	8.5	12.4	1.4	63.3	69.2	8.1	12.8	
01CAR									150.2									0.6
01SUN									28.7									3.3
02PAA	2.8	8.3	3.5	17.4	5.2	4.4				36.0	12.6	30.4	6.4	21.3	25.2			
02PAA							154.9									0.7		
02PAJ	3.1	8.3	8.2	5.1	3.9	5.8				33.0	12.6	12.9	21.8	28.4	19.2			
02PAJ							186.7	14.0	22.9							0.6	12.1	5.4
02PAK	1.7	11.0	3.1	5.1	3.9	5.8				58.3	9.5	34.1	21.8	28.4	19.2			
02PAK							685.1	18.4	17.6							0.2	9.2	7.0
02PAM									37.0									3.3
02PQR									20.5									6.0
03ASR							7.0	5.6								17.0	17.0	
03ASU	13.9	61.4	6.1	22.4	1.6	13.4				5.7	1.3	13.8	3.9	54.5	6.6			
04CAR																		
04SSO									21.7									6.1
04SU1							7.1	4.1								38.9	41.8	
04SU2							19.9	4.2	24.7							12.9	42.0	5.3
04SUN																		
04SUO							16.8	2.8	3.2							15.2	64.5	41.2
04SUS									6.4									20.7
05PAB	5.5	0.4	1.4	1.1						7.5	104.8	30.8	47.4					
05PAG	8.0	13.7	1.9	1.3						4.4	3.6	24.0	46.2					
05PDF	9.8	11.5	1.5	1.1						4.1	3.9	29.0	49.7					
06GOR	11.7	112.6		513.4	9.6	4.5	6.8	26.3	11.6	4.6	0.5	0.0	0.1	5.6	11.9	8.2	2.2	5.5
06SLL						1.9	5.0	10.1	2.3						28.6	11.2	5.6	28.1
06SUL	50.9	16.9		60.8	6.2					1.0	3.0	0.0	0.9	8.7				
07ASD	1.0	6.5	2.4	2.9	5.0	2.8	3.7	1.6	3.3	87.2	13.3	36.7	30.2	17.5	65.8	53.9	129.9	35.2
07BSU			4.8	4.4	6.9	2.4	3.5	2.1	2.0			19.7	21.4	13.8	73.0	52.5	73.7	58.0
07CAH						0.2									803.9			
07CAN							1.3	0.5	2.7							144.7	329.4	42.7
07CAR				6.2	4.0								19.0	24.3				
07DCA			5.9		0.8							53.7		124.5				
07ECZ			4.3	3.2	1.9							22.3	30.4	50.3				
07FSL			1.9		4.2	0.8						81.6		23.1	203.2			
07FWC			3.7	1.9	2.7							26.0	51.6	36.3				
07NSL							2.3	1.0	1.7							80.6	167.3	68.4
07SLL				2.3	2.1	4.5							168.0	47.2	54.3			
08ASA	4.0	2.3	2.1	2.3	6.9	4.6	4.5	1.6	13.0	22.2	38.6	43.2	40.9	12.9	19.3	20.4	58.2	7.6
08CAR	1.5	2.3	1.9	2.6	3.2	1.2	4.2	1.2	7.8	59.0	38.8	47.4	34.5	27.5	83.5	21.8	80.4	12.7
10GOF		14.4	19.9	13.4	6.0	79.9	11.5	16.4	14.7		6.6	4.9	7.6	17.0	1.3	9.3	6.5	7.8
10S32	37.4	53.8	22.1	70.8	4.0	7.0	37.1	28.6	6.5	2.7	1.9	4.8	1.6	27.8	11.8	3.1	4.1	19
10SF2				2.3	0.7								43.5	150.2				
10SSM	37.0	61.0	17.1	46.3	8.3	15.1	26.4	23.2	25.0	2.7	1.7	6.2	2.4	13.4	7.3	4.4	5.0	5.0
10SSS									20.1									6
10SUF		9.6	9.2								9.9	11.0						
11CRL	5.7	1.0	1.4	2.5						17.5	98.4	73.6	42.9	0.0				
11CRO		2.7	4.7	23.9	19.1						37.6	22.3	4.6	5.7				
13SOR	17.0	6.6	4.6							5.2	13.7	18.8						
14ACA	8.2	19.2	22.4	18.6	26.4	9.8	33.3	8.1	33.7	10.4	4.6	4.7	4.8	3.3	49.5	26.1	40.6	3.7
14BSU	6.9	18.2	15.2	7.5	15.8	9.9	23.3	8.4	27.4	16.5	6.4	7.5	16.0	7.6	66.2	21.2	22.0	4.5
15ASR	82.2	67.8	9.8	12.2						1.0	1.2	8.8	7.3					
15BSP	65.1	42.4	6.9	9.0						1.2	2.0	12.4	9.9					
16SNS	3.9	8.0	5.0	4.9	16.0		9.8	4.6	5.4	24.2	11.9	18.6	19.0	5.8	0.0	9.8	21.3	19.4
17GSR	6.2	16.7	4.4	12.2	1.4					16.7	6.1	23.6	8.4	73.9				
17H5S	8.4		5.4							8.6	0.0	13.3						
17OST	20.6	11.3	4.6	23.4						3.4	6.7	19.4	6.0					
18AST	8.4	3.7	20.0	57.2						15.2	35.7	6.8	2.4					
19ASM	2.7									36.9								
19ASM		371.1	29.9	143.1	6.6	26.1					0.3	3.5	0.8	16.8	4.3			
20S32	22.6	15.5	5.1	2.1	2.5	2.6				4.8	7.1	21.0	50.1	42.2	41.7			
20S36	22.6	15.5	5.1	11.1	4.3	3.1				4.8	7.1	21.0	9.6	25.1	34.6			
20SM1							1.4	1.9	16.6							79.3	57.5	7.0
20SM3							1.6	3.0	17.5							70.1	35.9	6.6
21AST	5.1	57.6	17.3	52.1	17.9					15.0	1.1	4.5	1.8	5.2				
21HO8						58.0	9.4	19.9	3253						1.1	7.0	3.3	0.0
22SUL	2.2	2.1								10.4	12.3							
22SUL			14.7									1.7						

Continued on next page

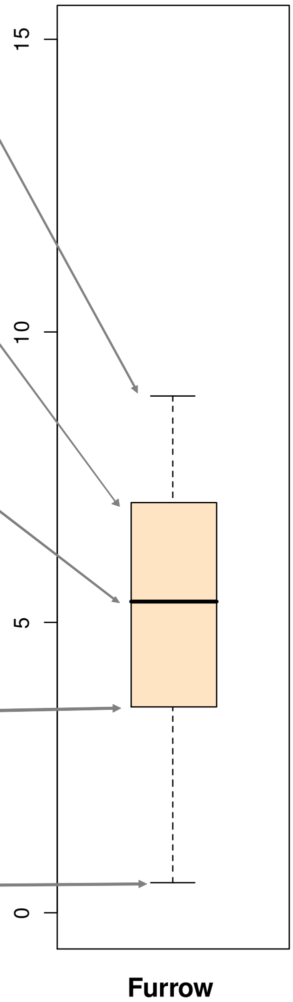
Site	Yield per volume of drainage (t/ML)									Cost of drainage per tonne of fruit ($/t)								
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003	2004	2005	2006	2007	2008	2009	2010	2011
23CLL	2.6	4.6	2.4	5.5	4.6	0.9	3.2	2.6	10.1	31.0	18.4	36.0	16.2	5.1	159.4	50.4	10.4	1.8
23COH	68.5	12.0	13.9	13.9	4.9	4.3	7.7	0.5	42.9	1.2	7.0	6.2	6.4	4.8	46.0	24.1	52.4	0.6
24SDR		71.3	32.0	225.7	15.9	27.2	31.2	13.9	35.0		0.4	0.9	0.1	1.8	1.0	8.4	8.6	1.1
24SOH		1.7	2.9	5.9	1.2	2.2	2.6	1.3	3.5		16.0	9.7	4.8	23.2	12.7	47.2	53.8	11.1
25COD	0.3	0.3	0.5	0.5	0.2	0.3	0.6	0.6	0.7	246.2	249.3	171.3	164.2	430.6	314.7	149.2	145.7	125.5
25COF	3.7	4.5	4.7	26.8	0.9	0.8	0.5	0.9	0.7	19.4	15.9	17.3	3.0	88.8	195.8	159.5	63.3	87.1
25SRD	0.5	1.0	1.0	0.8	1.0	1.2	1.1	3.5	1.4	170.8	81.7	79.0	105.3	78.1	88.9	76.6	23.7	66.8
25SRF	4.0	10.8	7.4	32.0	1.9	4.1	6.1	1.9	5.3	20.3	7.5	11.0	2.5	42.2	19.8	13.9	44.3	17.0
28BSE						51.0	8.2								3.4	24.2		
28BSO								1.9									47.4	
28BSU			1.8	5.9	87.9							47.4	14.1	1.0				
28CSE						84.4	18.3								2.0	10.8		
28CSN									24.9									3.6
28CSR								3.0									29.5	
28CSU			3.2	12.7	44.7							25.4	6.4	3.1				
28GOE						48.6	5.9	4.0							3.9	31.4	22.5	
28GOR			2.2	12.3	8.6							47.5	9.8	15.2				
28WAC			1.4	10.3	6.9							61.4	8.4	6.3				
28WOE						16.1	2.8								9.2	105.2		
29S4A	13.6	35.1	34.4	96	5.5	9.4	3.6	3.3		5.7	2.3	2.4	0.9	15.6	54.2	116.0	247.2	0.0
29S4B	31.2	85.1	65.4	4478	26.0	160.0	46.5	3.3		2.5	1.0	1.3	0.0	3.3	5.0	13.7	247.1	0.0
29SU1	4.4	18.4	13.5	158.5	11.5	1.4	1.2	2.9	19.6	17.8	4.4	6.1	0.5	7.5	326.7	350.5	284.2	5.1
29SU2	14.5	43.4	40.6	129.5	15.1	2.8	2.1	3.7	9.5	5.3	1.9	2.0	0.7	5.7	200.9	167.8	252.7	10.5
29SU3		31.9	18.3	227.6	7.0	1.2	3.7	7.9	4.6		2.5	4.5	0.4	12.4	342.2	108.3	139.6	19.4
30SUL				5.7	16.4	8.0	7.5	3.7	19.1				17.2	5.9	16.6	35.2	62.7	5.8
31CUR					0.5									78.3				
31GOR					0.8									108.2				
31GOR						14.1	13.4	19.6	8.0						14.1	24.0	14.6	12.9
31SUL					0.7									124.3				
31SUN						99.6	11.9	10.8	17.6						2.1	21.6	21.8	5.9
32CAR					2.6	1.1	1.9	1.2						30.9	70.1	63.6	71.2	0.0
32CRA						6.2	6.1	8.0	1.6						12.9	24.1	10.4	54.7
32CRU					0.3	6.0	4.6	5.5	0.9					297.6	13.3	31.8	15.2	97.3
32CSC					2.4	6.6	4.1	6.2	3.1					32.9	12.0	36.1	13.3	28.7
32SMU					1.7	1.4	0.6	0.8	26.2					47.4	56.6	185.7	99.0	3.4
32SUL					3.7	0.8	1.6	0.9						21.5	98.0	75.9	90.6	0.0
33GOR					49.8	8.5	122.7	10.8	35.6					0.3	16.4	3.2	12.5	0.5
33SUL					34.8	13.2	104.3	2.9	25.9					0.4	11.1	4.0	47.8	0.7
34CAA					2.1		6.1	3.8						34.2		13.5	22.2	0.0
34CAB					13.3			3.6	43.6					6.1			23.4	2.1
34SSB							17.8	10.5								4.7	8.0	
34SUA					2.0		2.4	4.9						42.0	0.0	34.7	17.2	
34SUB					3.7									21.7	0.0			
35SNO					4.4									4.4				
36CAP							2.1	1.7	0.8							49.9	92.2	63.0
36CAR							2.1	1.7	1.0							58.5	92.2	51.6
36SUL					4.6	1.7	3.6	2.4	2.1					12.1	81.5	24.2	49.9	18.5
36SUN					2.2	1.0	1.3	1.4	1.2					19.7	122.6	74.9	92.2	41.3
37CAR					2.1	1.5	6.9	0.9	20.9					40.8	36.1	3.1	65.1	3.1
37SUN						1.7	6.6	1.6	17.4						32.9	8.7	35.7	3.7
39SU7						1.3									84.1			
39SU7							16.9	3.7								14.7	26.6	
39SUD									3.6									35.7
39SUJ						8.8	4.7	20.6	0.5						11.6	75.2	5.6	220.7
39SUS					2.3									41.7				
40SUE						0.9	1.0	0.5							91.7	88.6	177.0	
40SUL					1.8									43.4				
41SFF							3.4	1.6								60.5	51.6	
42SAC								0.5									184.0	
42SEG								0.5									184.0	
42SUB								0.5									184.0	
42SUD								0.5									184.0	
42SUN								3.7	13.6								22.3	6.6
43GOR								11.3	9.9								11.4	14.1
43SUL								2.5	9.7								52.2	14.5
43SUN								3.9	5.9								33.0	23.7
44SUL								0.9	8.3								123.8	13.8
45SUL									3.1									10.7
45SUN									2.0									17.1

D. Interpretation of box plots

A box plot is an excellent tool for illustrating the distribution and location of performance indicators for the sites under study. It is very efficient and useful for identifying outliers and for comparing distributions. The figure below describes the different components of a box plot regularly used throughout this report.



Yield (t/ha)	Site (Drip)	Index	Site (Furrow)	Yield (t/ha)
14.6	36SUL-Su	19	28CSE-Su	8.9
12.8	33GOR-Go	18	10GOF-Go	8.6
12.5	16SNS-Su	17	39SUJ-Su	8.0
12.3	14ACA-Ca	16	32CAR-Ca	7.8
8.4	37CAR-Ca	15	41SFF-Su	7.5
8.1	37SUN-SM	14	32SUL-Su	6.6
8.0	29SU2-Su	13	25SRF-Su	6.5
7.6	07NSL-Su	12	40SUE-Su	5.8
7.6	29SU3-Su	11	34CAA-Ca	5.6
7.5	06GOR-Go	10	32CRA-Ca	5.4
6.7	29S4B-Su	9	32CRU-Ca	4.1
6.7	29S4A-Su	8	28WOE-Wa	4.0
6.5	04SU2-Su	7	28BSE-Su	4.0
5.5	04SUO-Su	6	32CSC-Ca	3.6
5.5	31SUN-SM	5	28GOE-Go	3.5
5.5	08ASA-Su	4	34SUA-Su	3.1
3.2	25COD-ZC	3	34SSB-Su	3.1
2.4	29SU1-Su	2	32SMU-SM	3.0
1.7	31GOR-Go	1	25COF-ZC	0.5



IR: Inter-quartile range, i.e. 75th percentile - 25th percentile.

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