Extension of the results from the project VX00019 to improve the sugar-content and quality of rockmelons

Gordon Rogers
Applied Horticultural Research P/L

Project Number: VX04002

VX04002

This report is published by Horticulture Australia Ltd to pass on information concerning horticultural research and development undertaken for the melon industry.

The research contained in this report was funded by Horticulture Australia Ltd with the financial support of Multiflex and T-Systems.

ISBN 0 7341 1607 1

Published and distributed by:

Horticultural Australia Ltd

Level 1
50 Carrington Street
Sydney NSW 2000
Telephone: (02) 8295 2300
Fax: (02) 8295 2399

E-Mail: horticulture@horticulture.com.au

Know-how for Horticulture™

Project Number: VX04002

VX04002 - Extension of the results from the project VX00019 to improve the sugar-content and quality of rockmelons.

Gordon Rogers

Applied Horticultural Research Pty Ltd

Horticulture Australia
Project Number: VX04002

Project Leader

Dr. Gordon S. Rogers
Applied Horticultural Research
Po Box 3114
BUNDEENA NSW 2230

Key Personnel

Gordon Rogers – AHR
Brad Giggins – AHR
Tony Hartley - T systems

Funding Sources

The funding for this project comes from T-Systems Australia who contributed the VC for the project and this was matched by HAL. Total funding for the project was $108,265.

Funding by both the Industry and HAL is gratefully acknowledged by Applied Horticultural Research.

Date: June 2007

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

Contents

Media Summary

An earlier rockmelon quality project developed agronomic techniques which has enabled growers to increase their average soluble solids level from an industry average sweetness of 8.4 % to an average of 11.4 % with no loss in yield.

However, rockmelons on the Sydney market still remain variable and sweetness ranged between 15.2 and 5.2 % with the average ranging from 12 % to 8.3 %.

Troughs in the soluble solids levels have approximately coincided with fruit from the MIA and Kununurra growing regions. Fruit from other areas such as Mildura, North Qld, Burnett and Katherine have been consistently better.

The key difference between Kununurra, MIA and other melon growing areas is that these areas still use flood (furrow) irrigation compared to trickle in the other areas.

When well-managed trickle irrigation was compared to flood irrigation at Kununurra, it resulted in the fruit sweetness of 12 % compared only 10.3 % for the flood-irrigated crop with no difference in yield or individual fruit weight.

Flesh firmness was also higher in trickle-irrigated compared to flood when the plants were kept free of water stress, but lower when the plants were stressed during fruit development.

A field day was held for local growers on the 17th August 2005 to view the trials and discuss the work with the grower and AHR staff. Several growers attended, and given that the melon industry in Kununurra is made up of a very small number of large growers, this was a pleasing result.

Technical Summary

Project VX00019 focused on developing agronomic techniques to improve the quality of rockmelon and honeydew fruit. This has been highly successful, and by adopting the techniques developed, co-operating growers have been able to increase their average soluble solids level from an industry average of 8.4 % soluble solids to an average of 11.4 % with no loss in yield.

However, rockmelon fruit soluble solids levels on the Sydney market still remain variable and range between 15.2 and 5.2 % with the average ranging from 12 % to 8.3 %.

The troughs in the soluble solids levels have approximately coincided with fruit from the MIA and Kununurra growing regions. Fruit from other areas such as Mildura, North Qld, Burnett and Katherine have been consistently better.

The key difference between Kununurra, MIA and other melon growing areas is that these areas still use flood (furrow) irrigation compared to trickle in the other areas.

The overall principle for accumulating sugar in the fruit is that the plants must be kept healthy and functioning right up to harvest. It is during the last 10-14 days of fruit development, after the fruit have reached full size that is the most significant for sugar accumulation in the fruit. It is crucial to avoid water stressing the plants from fruit set right through to the last pick. This means monitoring soil moisture levels objectively and using buried trickle irrigation to precisely control soil moisture in the root zone.

When well-managed trickle irrigation was compared to flood irrigation at Kununurra, it resulted in the fruit soluble solids concentration of 12 % compared only 10.3 % soluble solids for the flood-irrigated crop with no difference in yield or individual fruit weight.

Flesh firmness was also higher in trickle-irrigated compared to flood when the plants were kept free of water stress, but lower when the plants were stressed during fruit development.

A field day was held for local growers on the 17th August 2005 to view the trials and discuss the work with the grower and AHR staff. Several growers attended, and given that the melon industry in Kununurra is made up of a very small number of large growers, this was a pleasing result.

Introduction

Project VX00019 has focused on developing agronomic techniques to improve the quality of rockmelon and honeydew fruit. This has been highly successful, and by adopting the techniques developed, co-operating growers have been able to increase their average soluble solids level from an industry average of 8.4 %soluble solids to an average of 11.4 % with no loss in yield.

Rockmelon collected from the Sydney Market however are still variable, and troughs in the soluble solids levels have approximately coincided with fruit from the MIA and Kununurra growing regions. Fruit from other areas such as Mildura, North Qld, Burnett and Katherine have been consistently better.

This indicates that growing practices clearly have an effect on fruit quality, and that some growers have got the message and are improving, while other growers are just focusing on yield and are not producing quality fruit.

The overall principle for accumulating sugar in the fruit is that the plants must be kept healthy and functioning right up to harvest. It is during the last 10-14 days of fruit development, after the fruit have reached full size that is the most significant for sugar accumulation in the fruit.

Then three main areas where growers can make a difference here are in:

- Irrigation management
- Crop nutrition
- Root health

Irrigation management: It is crucial to avoid water stressing the plants from fruit set right through to the last pick. This means monitoring soil moisture levels objectively and using buried trickle irrigation to precisely control soil moisture in the root zone.

It is not possible to maintain the level of control of soil moisture using flood irrigation, as is commonly practiced in the MIA and Kununurra. The practice of “drying crops” down during late fruit development and harvest is highly detrimental to fruit sugar levels.

Nutrition: Nitrogen is important for photosynthesis which produces the sugar for fruit. It is important there is enough N available for the plants for function well into harvest. Other key elements are potassium, calcium and boron. Potassium is critical all through fruit development, while calcium and boron supply are most important around flowering, fruit set and early fruit growth.

Root health: Healthy roots are also key because of the roots are small or diseased, the plant is not able to take up sufficient water and nutrients when required, especially in the key later stages of plant growth.

The best results have been achieved by the growers who have actually participated in the trials. They have been able to improve average fruit soluble solids levels by about 3^{o} Brix, raising the quality from average to outstanding.

The objectives of the project are to work closely with key growers, especially on trickle irrigation in Kununurra and try to encourage farmers to manage their irrigation in a way that will maximise fruit yield and soluble solids levels.

The message will then be transferred to other growers in these regions once these key growers start to see significant improvement in the quality (and market price) of the fruit they are producing.

Key Findings from the Rockmelon Project

Sugar Accumulation Mechanism in Melons

Sugars accumulate mainly in the last 14 days of fruit growth after fruit growth stops. Sugar comes from healthy mature leaves by photosynthesis (Fig 1).

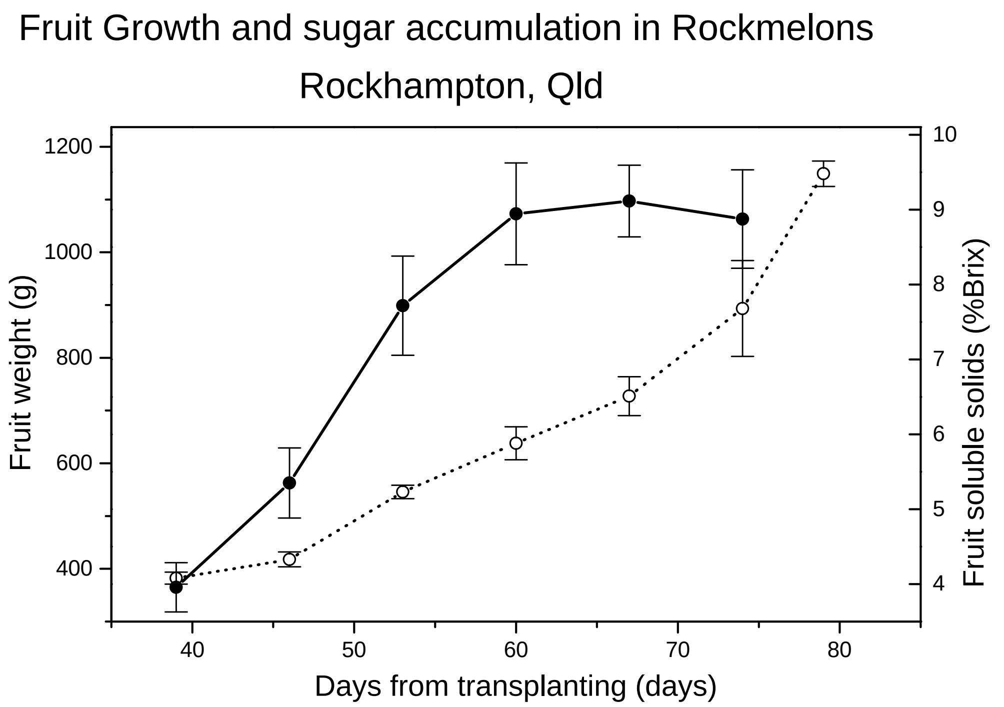


Figure 1. Pattern of sugar accumulation in rockmelons. The unbroken line indicates fruit weight and the broken line indicates fruit soluble solids.

This sugar then moves from these mature leaves to the fruit. This means that the leaves must be healthy and functioning right through to the end of the harvest period to maximise sugar in the fruit.

Water stress reduces the photosynthetic rate by causing the stomata in the leaves to close. This blocks movement of the gases required for photosynthesis, and the leaves stop producing sugar.

Photosynthetic rate is strongly related to leaf Nitrogen concentration. If the plants run out of Nitrogen while the fruit are maturing, then photosynthesis is reduced.

The more fruit on the plant, the “thinner” the available sugar will be spread.

Irrigation management

One of the key findings of the project has been that plants must be kept free of water stress from flowering right through until the end of harvest. Any water stress during fruit development reduces sugars in the fruit (Fig. 3).

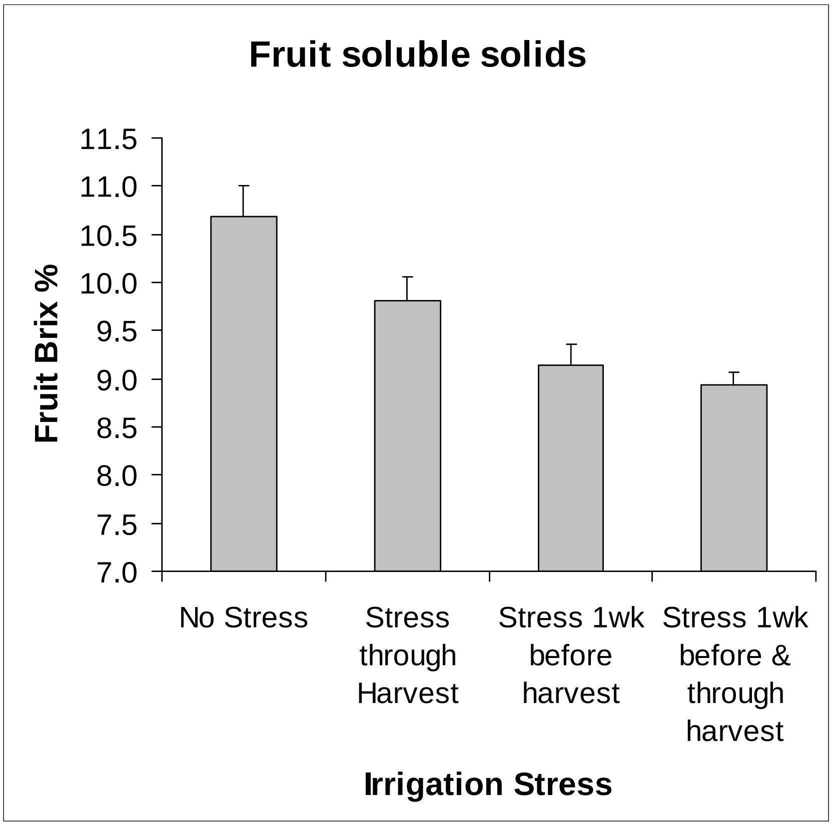


Figure 2 Effect of water stress on rockmelon fruit soluble solids concentration

This means that plants should not be “dried down” prior to harvest or through the harvest period.

Some form of soil moisture monitoring is essential to assess what is happening to soil moisture levels, especially if subsurface irrigation is used.

The following irrigation strategy has been developed as a guide to irrigation management.

Table 1 Irrigation Strategy for maximising fruit soluble solids

Stage of crop growth	**Strategy**	**Objective**
Sowing or transplanting to first male flower	Irrigate to field capacity immediately after planting. Monitor soil moisture and irrigate only when plants become excessively stressed.	**Development of a large root system.** The idea is to dry the soil down the encourage roots to grow in search of moist soil. Buried trickle helps achieve this objective. Subjecting the plants to a mild water stress at this stage will not reduce yield or fruit Brix.
Flowering to harvest	Irrigate when the soil reaches refill point or when the rate of water extraction by plants from the soil begins to slow down. Then, irrigate the soil fully up to field capacity. Do not over-irrigate, and avoid short partial irrigations.	**Keep plants free of water stress during the fruit growth and sugar accumulation phases.** Each irrigation encourages root rotting fungi to kill off roots hairs. Keep the number of irrigations to a minimum but do not subject plants to stress.

Harvest period	Maintain normal irrigation as per flowering to harvest. Some trial data suggests a mild stress such as: missing a single irrigation just before harvest, or irrigating half as often during harvest increases sugars but most data suggests maintaining normal irrigation through harvest is best. **<u>Do not dry off plants prior to, or during harvest</u>.**	**Keep plants free of water stress to enable late maturing fruit to accumulate sugars prior to ripening.** Fruit that will be picked two weeks after the start of harvest has not yet gone through its sugar accumulation phase. This fruit needs to be well supplied with water to aid the accumulation of sugars. This cannot be achieved if the plants are water stressed. **<u>This is a significant change to conventional practice, but is essential for to maintaining sugars during harvest.</u>**

Crop Nutrition

The key point with nutrition is to obtain a pre-plant soil test to collect some basic information about the soil nutrient levels and physical properties.

During crop growth, the plant nutrient status should be monitored using leaf analysis once at flowering and again at mid fruit development. The results can be used to monitor crop progress and fine-tune the nutrition program and are especially useful while trying to develop a successful nutrition program.

Sap testing can also be useful, especially for monitoring plant nitrate and potassium levels. Plant leaves must be kept healthy and functioning right up to harvest. It is during the last 10 days of fruit development, after the fruit have reached full size, that is the most significant time for sugar accumulation in the fruit.

Table 2. Nutrient Target levels in the Youngest Fully Expanded Leaf

Nutrient		Flowering to Fruit Set Stage	Mid Fruit Development	Harvest
Nitrogen*	%	5.5 ... 6.0	3.5 ... 4.5	3.0 ... 3.5
Phosphorus	%	0.5 ... 0.8	0.3 ... 0.7	0.3 ... 0.7
Potassium	%	4.0 ... 6.0	2.5 ... 4.0	2.0 ... 4.0
Calcium	%	3.5 ... 4.0	3.5 ... 5.0	4.0 ... 5.0
		0.4	0.3	0.3
Magnesium	%	0 ... 1.0	0 ... 1.0	0 ... 1.0
		0.4	0.5	0.5
Sodium	%	0.0 ... 0	0.0 ... 0	0.0 ... 0
Sulphur	%	0.5 ... 1.0	0.5 ... 1.0	0.5 ... 1.0
Zinc	mg/kg	20 ... 60	20 ... 60	20 ... 60
Iron	mg/kg	40 ... 300	40 ... 300	40 ... 300
Copper	mg/kg	5 ... 20	5 ... 20	5 ... 20
Manganese	mg/kg	20 ... 400	20 ... 400	20 ... 400
Boron	mg/kg	30 ... 200	30 ... 200	30 ... 200

* Nitrogen levels are quite high relative to common practice. In trials conducted over the duration of this project these N levels have been achieved without leading to soft fruit. However, these target levels should be treated with caution and grower experience used when considering N applications.

Maintaining Root Health

Maintaining a healthy root system through to the end of harvest is a crucial factor in producing sweet fruit. Vines which collapse at the start of harvest or even before harvest begins do not have healthy root systems. A line of browning leaves down the centre of a row which is often seen as the fruit nears maturity, is not normal and is a sign of an unhealthy root system.

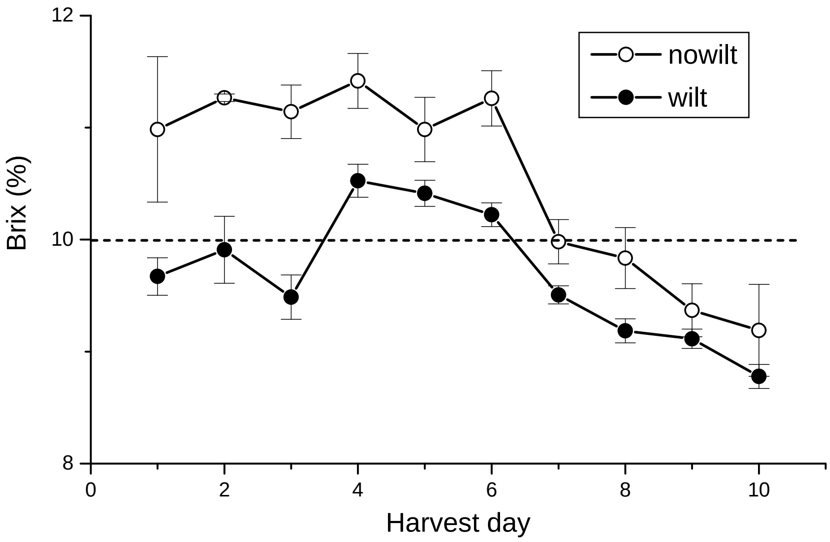


Figure 3. Effects of Sudden wilt on Rockmelon Brix levels in Kununurra.

Modern melon varieties are highly susceptible to poor root health because they have been bred for high yield and a large vine to protect the fruit from sunburn. There has been no selection for root size, which has tended to remain just large enough to support the plant.

The roots are operating at the upper limit of their capacity to supply water and nutrients to the plant. Anything which reduces root system efficacy can result in roots not being able to keep up with the demand of the leaf, stem and fruit.

Anything which affects the efficiency of the roots then starts to impact on fruit quality. This is most pronounced as the fruit mature near harvest. Some symptoms of unhealthy roots are:

- Plants wilting in the middle of the day
- Browning of leaves along the centre of the bed
- Plants start to collapse after the first harvest
- Patches of dead leaves and exposed fruit
- In the extreme cases, the result is sudden wilt, where large areas of vines collapse near harvest.

The following growing practices can contribute to unhealthy roots. Crops may be able to withstand one or more of these factors and still produce healthy crops, however the more of these factors which are present together, the more difficult it will be for roots to supply water and nutrients and for the crop to produce sweet fruit.

- Excessive watering, especially between planting and first flower.
- Plastic mulch
- Trickle irrigation tube on the surface of the soil, especially under plastic
- Previous crops of cucurbits
- Prevalence of root rotting diseases in the soil such as Fusarium

Seedlings v's Direct Seed Establishment

These 2 methods of seedling establishment produce very different root architectures.

Figure 4. Rockmelon roots on plants established by transplanting (left) and direct seeding (right)

Direct – seeded crops develop a strong taproot with a deep root system. Transplants produce a much more lateral roots system based on adventitious roots (Fig. 4).

The main thing is to manage the irrigation according to where the roots are. If the roots are mainly surface and lateral, growers have to manage the soil in that area carefully. If the roots are deeper, then the profile down to around 50cm needs to be monitored.

What was achieved?

At the start Data collected by Prof Walsh in 1998-9 showed that the average Brix of melon produced in Queensland was 8.4% sugars with 50% of fruit below 8.7% (Fig. 5). Consumers don't regard a rockmelon as a really good eating experience until the sugars reach about a Brix of 10.

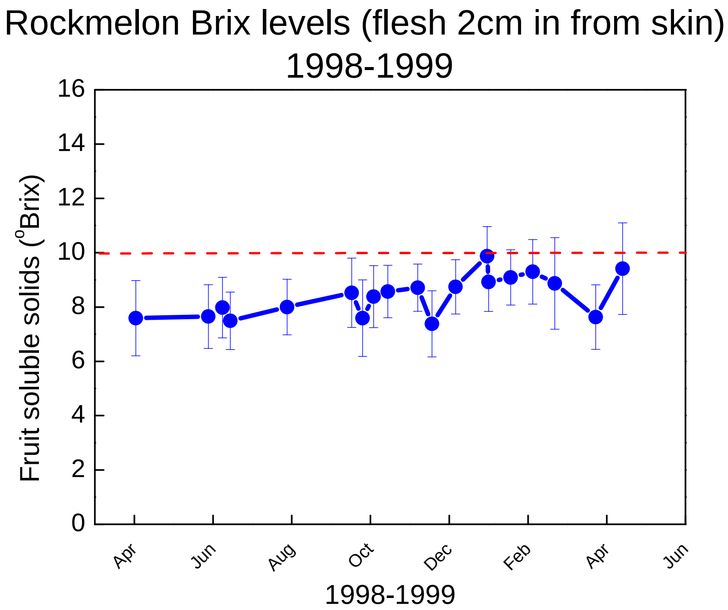


Figure 5. Rockmelon soluble solids levels in 1998-1999 season in Queensland

After implementation of the project between 2001 and 2004. Data from Back O Bourke fruits, collected over summer, 2004 using the NIR on their ColorVision grader, showed that a Brix level of 11.4 was able to be achieved

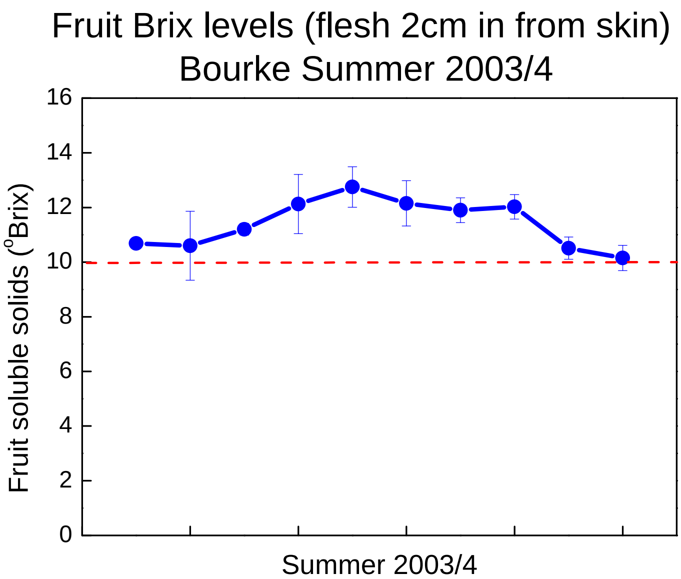


Figure 6. Fruit Brix Levels, Bourke 2004 recorded by the NIR.

Survey of Rockmelon Soluble Solids on the Sydney Market

The overall aim is to eventually improve overall sales of Rockmelons, however there were two short-term aims of the project:

1. Collect baseline data on the average Brix level in fruit consumers are currently buying, and
2. Try and shift some focus onto quality, rather than just size and external appearance.

There has been some criticism that Brix is not the whole story when it comes to measuring rockmelon quality, and this may certainly true. However, Brix is a simple test to carry out compared to measuring volatile compounds (the other main flavour component) which requires expensive laboratory equipment costing several hundreds of thousands of dollars.

Quality sensory evaluation data is also required to answer these two important questions:

- Is Brix a good indicator of rockmelons (and honeydew) eating quality, and
- If so, at what level of Brix do consumers regard as a “good eating experience”.

Brix Variability in Rockmelon Fruit

There is enormous variation in the Brix level in a rockmelon. Most of the variation occurs from outer to inner flesh and the soluble solids commonly varies by up to 7-8 ^{o} Brix across the fruit flesh. Leigh Barker (QDPI) has measured this variation in rockmelon Brix across fruit and his results show this variability very clearly in Fig. 7.

This variability of Brix in the fruit raises the critical issue of where should you take a fruit sample if you want to get a result that is both repeatable and representative of the eating experience.

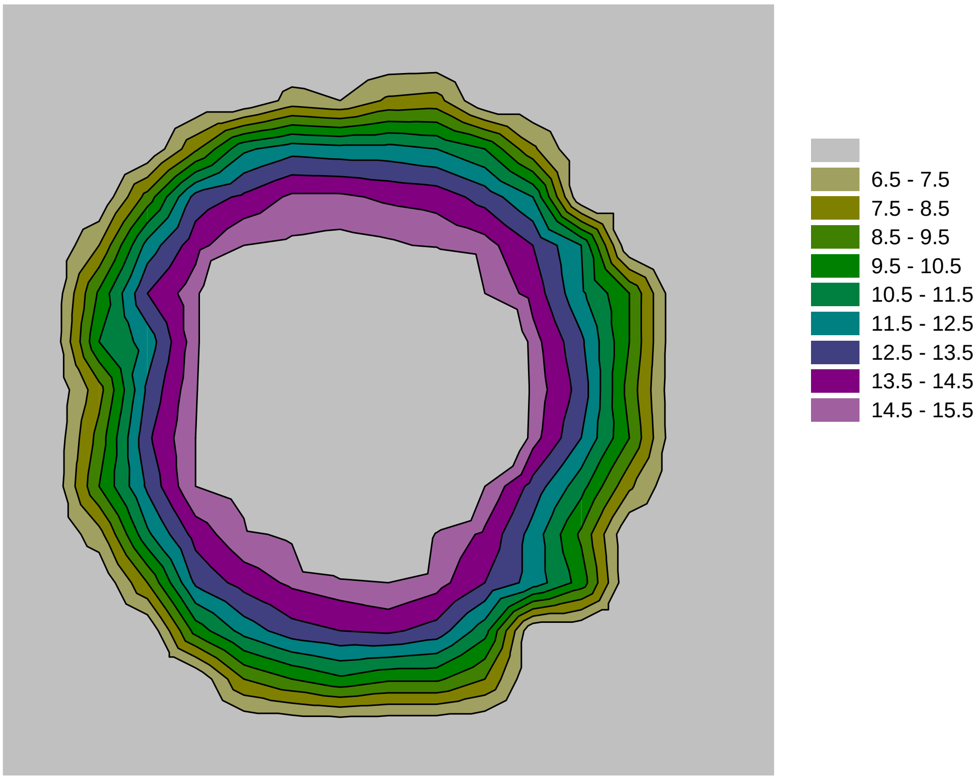


Figure 7. Distribution of Brix levels in Rockmelon Fruit (courtesy Leigh Barker, QDPI).

Brix Testing Methods Used in the Survey

Three different Brix testing methods were used in the survey. Each piece of fruit sampled in the study had the Brix measured by all methods. These methods were:

- **Whole flesh** – Cores were taken from either side of the fruit around the midline. The skin and seed were trimmed off the outer edge of the core, and the seed cavity remnants were removed from the inner section of the core. Both cores are then crushed, and the Brix of the whole sample measured using a refractometer.

- **Slice test** – A slice of the fruit was taken from the stem end to the flower end. The seed remnants were cut off and the juice squeezed on to a refractometer and the Brix measured. This method is commonly used by QA for Woolworths, Coles.

- **Scratch test** – The fruit was cut longitudinally and a sample of the juice from around seeds was placed onto the refractometer and the Brix measured. This is the method commonly used by growers, agents and buyers.

Of the three testing method used, the whole flesh method is the one that gives the closest estimate of what consumers are eating but it is very time consuming.

The *scratch* and *slice* tests are much easier to carry out, but do they do not give an accurate measure of average fruit soluble solids concentration in the fruit. The soluble solids levels found using the *scratch* test and the *slice* test were then plotted against the *whole flesh* method to gauge which method was best.

The *slice* method gave a better estimate of whole fruit brix than the scratch method, but both gave a Brix level that was actually higher than the *whole flesh* method (Fig. 8).

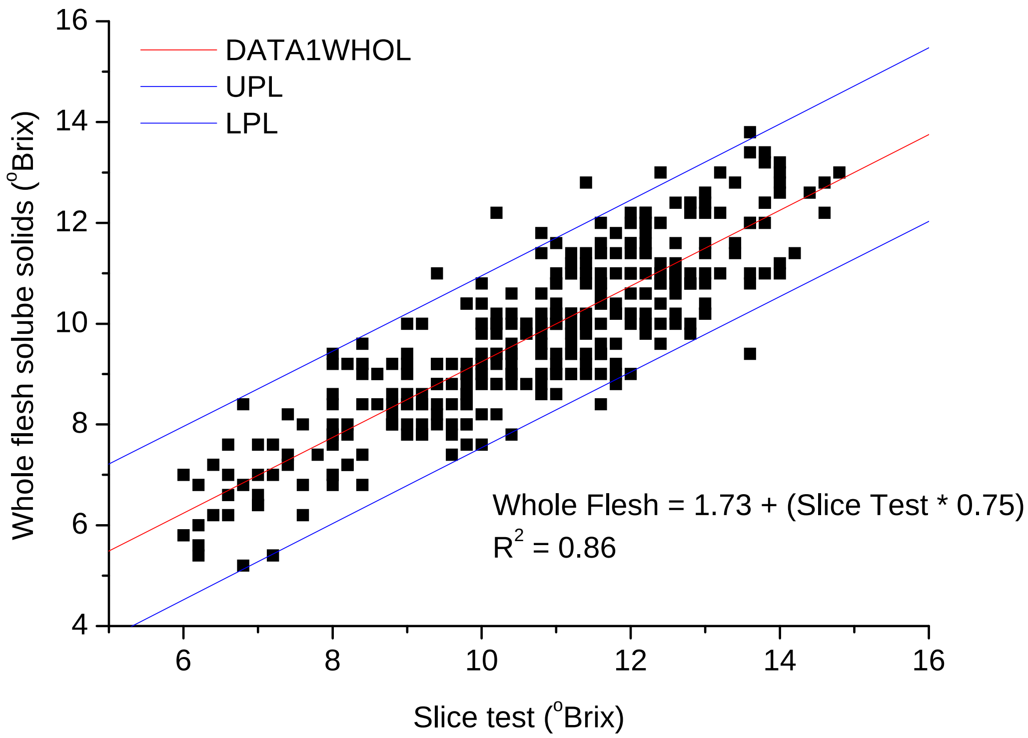


Figure 8. Comparison Between Rockmelon Brix measured using the Slice method Compared to the Whole Flesh Brix. The red line is the average Brix and the blue lines indicate the variability.

The *scratch* test gives the highest Brix reading, and this is the test that most growers and agents would currently use. The problem is that it really only samples the juice from the seed cavity which is the sweetest part of the fruit. The *scratch* result can be almost 5 Brix higher than the whole flesh result, and usually at lest 2 Brix higher.

The comparison between Brix levels found using the three methods is shown in Table 1. A *whole flesh* Brix of 10 is equivalent to a *scratch* test Brix of 12.2 and a *slice* test Brix of 11.0 (Table 3).

Table 3. Comparison between Rockmelon Fruit Brix Measured by the Whole Flesh, Slice and Scratch methods.

Whole Flesh	Slice Test Result	Scratch Test Result
7	7.0	8.0
8	8.4	9.4
9	9.7	10.8
10	11.0	12.2
11	12.4	13.7
12	13.7	15.1
13	15.0	16.5
14	16.4	18.0
15	17.7	19.4
16	19.0	20.8

It would be possible to measure Brix using the Slice method which is quick and easy to do, and convert the result to the equivalent whole flesh which better represents the consumer eating experience, using table 1.

Results and Discussion

Between 5 and 7 trays or occasionally bushels, were sampled from the Sydney Market each fortnight. The fruit was generally supplied by the collaborating agents: Perfection Fresh, Tristate, Col Johnson, Action Fruit Supply, Sunfresh and Coles. Occasionally, additional trays were purchased off the market.

About 1000 fruit were sampled from all regions over 12 months, and the Brix measured by all 3 methods on each fruit. The results were reported every fortnight on AMA website.

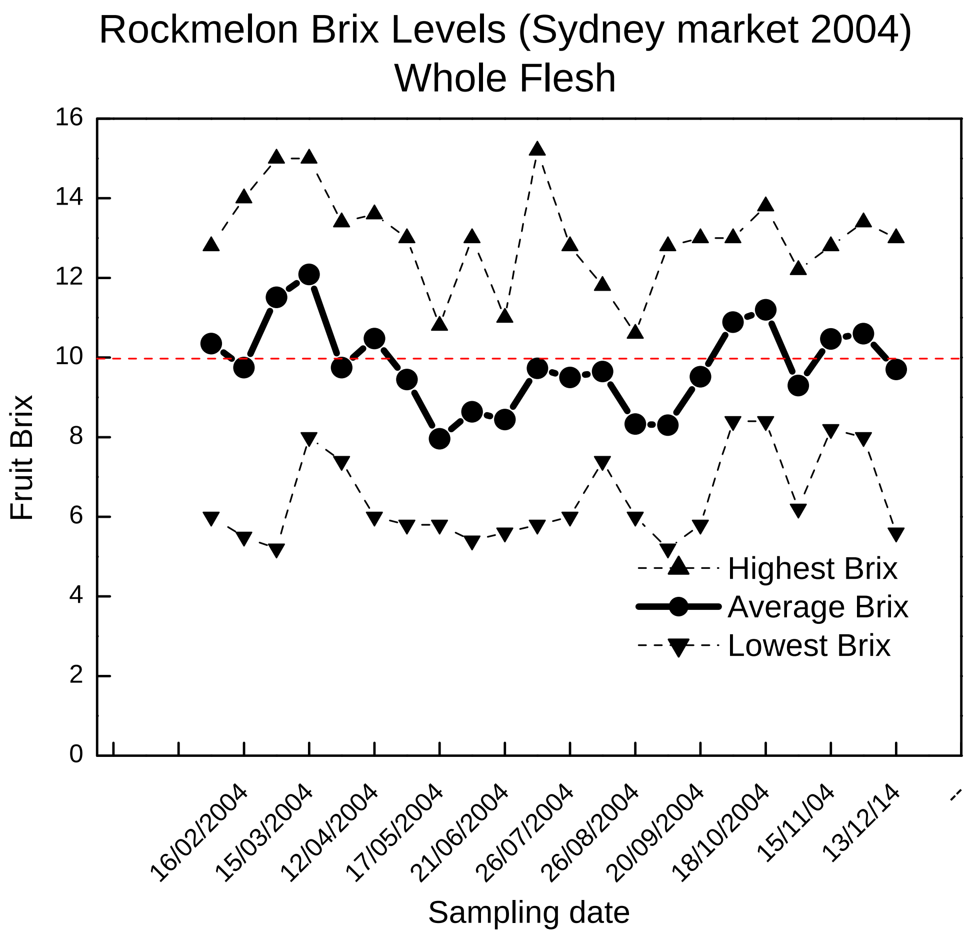


Figure 9. Results of the Sydney Market Rockmelon Brix Survey, 2004.

The average soluble solids, measured by the *whole flesh* method was 9.8 ^{o} Brix on average over the year, with individual fruit ranging from between 5.2 and 15.2.

There were clear trends in fruit Brix levels over the year. The sweetest fruit on the market was around late February to early March, and then again from late September through to December.

The poorest fruit was on the market around May to June. Brix levels rose in July to about 10, then fell again in August.

Over the year 46% of the fruit sampled were below 10 ^{o} Brix using the whole flesh method.

Brix levels measured using the slice method were 0.9^{o} Brix higher than the whole flesh method. The Scratch test method gave a Brix value 1.8^{o} Brix higher than the whole flesh method. If the whole flesh method can be considered the best measure of the Brix consumers experience when eating the fruit, then higher Brix readings using the scratch or slice methods needs to be taken into account when interpreting soluble solids readings for fruit.

Kununurra Winter 2005 Trickle Irrigation Trial

Introduction

Demonstration trials were set up with a rockmelon grower at Kununurra with the objective of assisting him with the management of trickle irrigation and comparing quality with melons produced using flood irrigation.

Materials and Methods

The trials were set up at Barradale Farms, Kununurra, WA. Irrigation was supplied 250 L/h/500m trickle irrigation tape (T-Systems, Australia) installed in the centre of each 1.8m wide bed at a depth of 10 cm and connected to Layflat ® sub main in a medium clay alluvial soil to which nitrogen; phosphorus potassium had been applied at 50:40:50 kg/ha respectively.

There were two varieties tested over two separate plantings. These were cv. Hotshot (Planting 1) and cv. Sienna (Planting 2).

Rockmelon plants were established by direct seeding above the trickle tube and the soil was irrigated to field capacity within 4 h of seeding. At the same time, a rockmelon crop was established in the same way except that furrow irrigation was used instead of trickle.

Each planting was 2 ha in area and was replicated in time over six successive plantings. Two EnviroSCAN probes (Sentek, Australia) sensors were installed in two of the plantings, one in the centre of the row and another installed 20cm out from the centre. Data was collected using an RT6 data logger (Sentek, Australia) and downloaded daily via a mobile phone connection. Each day, a daily a report was faxed to the grower which he then used to schedule irrigations.

Results and Discussion

Trickle irrigation on planting 1 (cv. Hotshot) resulted in a lower yield (Fig. 10), fruit weight (Fig. 13) and fruit soluble solids (Fig. 11) than for flood irrigation. This yield difference was due to a higher level of fruit rots in trickle irrigated fruit where the soil was moist on the surface (Fig. 14) and the water management of this planting was not ideal. The plants were allowed to go under water stress during fruit development and this would have reduced both yield and sugar development in the fruit (Fig. 15).

When the trickle irrigation was managed better so that the plants did not go under significant water stress during fruit development (Fig. 16), the fruit soluble solids concentration of the trickle-irrigated fruit was significantly higher ($P<0.05$) at 12 ^{o}Brix compared only 10.3 ^{o}Brix for the flood-irrigated crop (Fig. 11) with no difference in yield (Fig. 10) or individual fruit weight (Fig. 13).

Flesh firmness was higher in trickle-irrigated compared to flood when the plants were kept free of water stress, but lower when the plants were stressed during fruit development (Fig. 12).

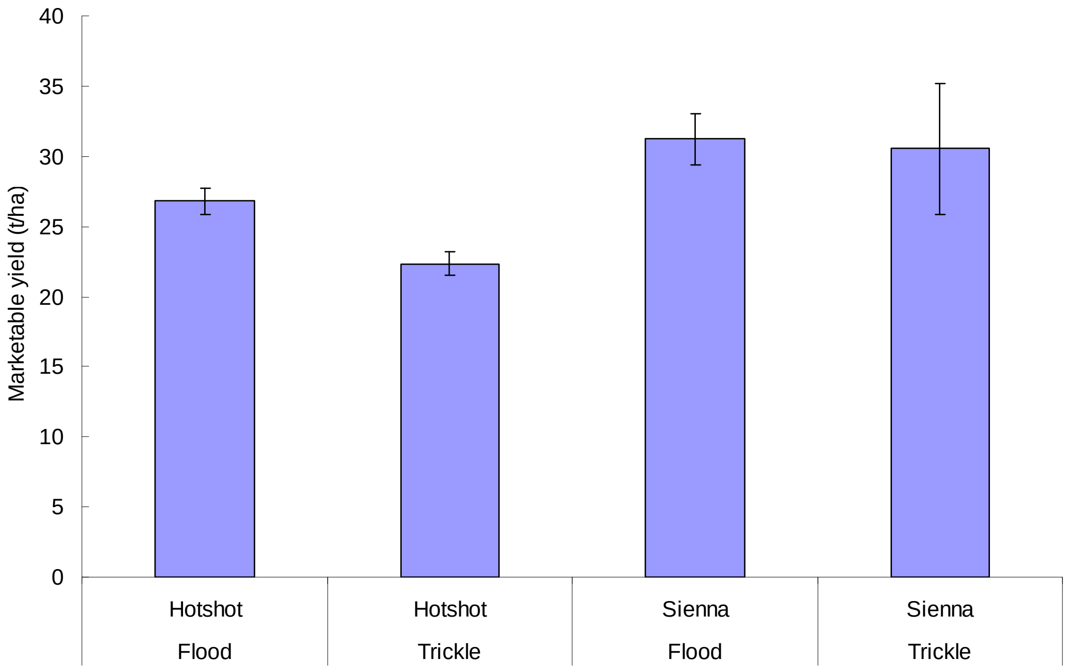


Figure 10. Yield of marketable rockmelon fruit varieties Hotshot and Sienna grown on either trickle or flood (furrow) irrigation.

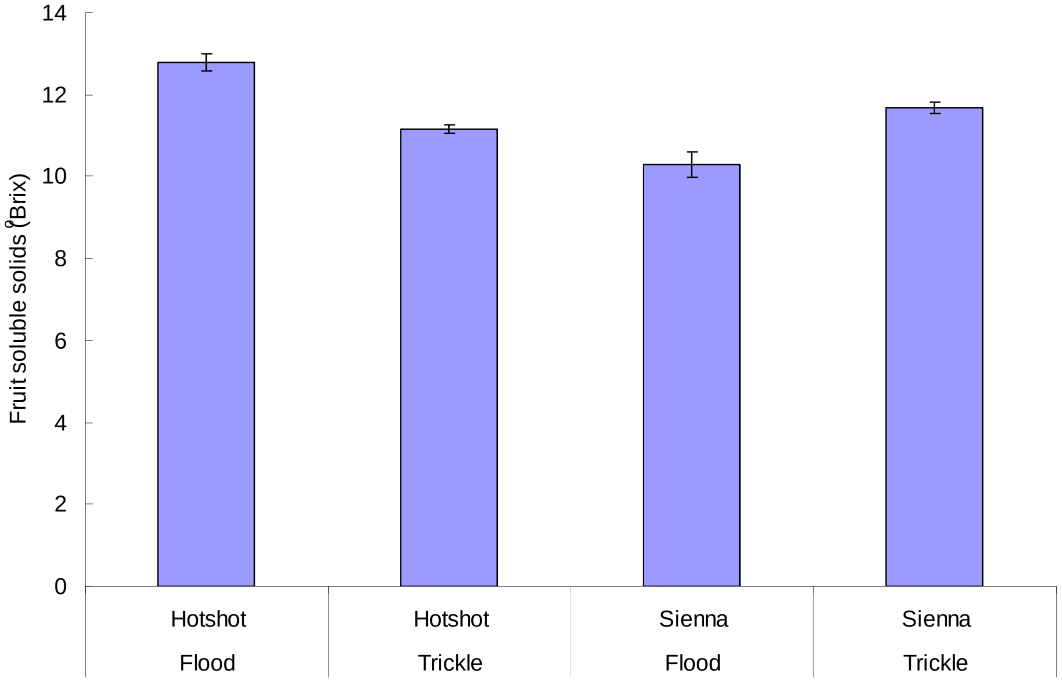


Figure 11. Soluble solids of rockmelon fruit varieties Hotshot and Sienna grown on either trickle or flood (furrow) irrigation.

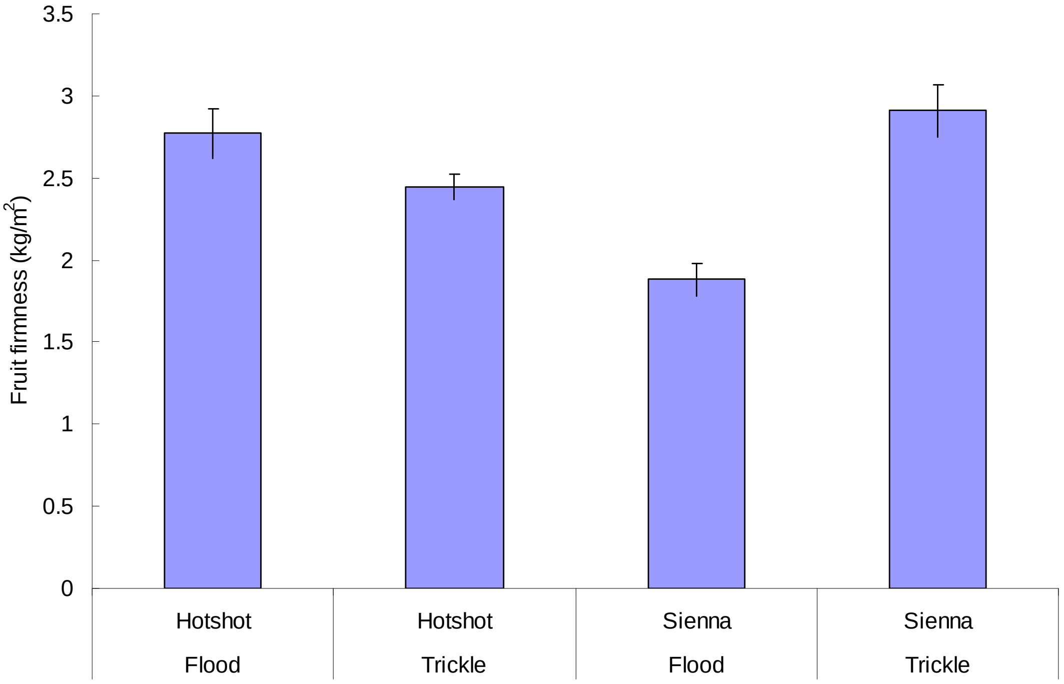


Figure 12. Firmness of the flesh of rockmelon fruit varieties Hotshot and Sienna grown on either trickle or flood (furrow) irrigation.

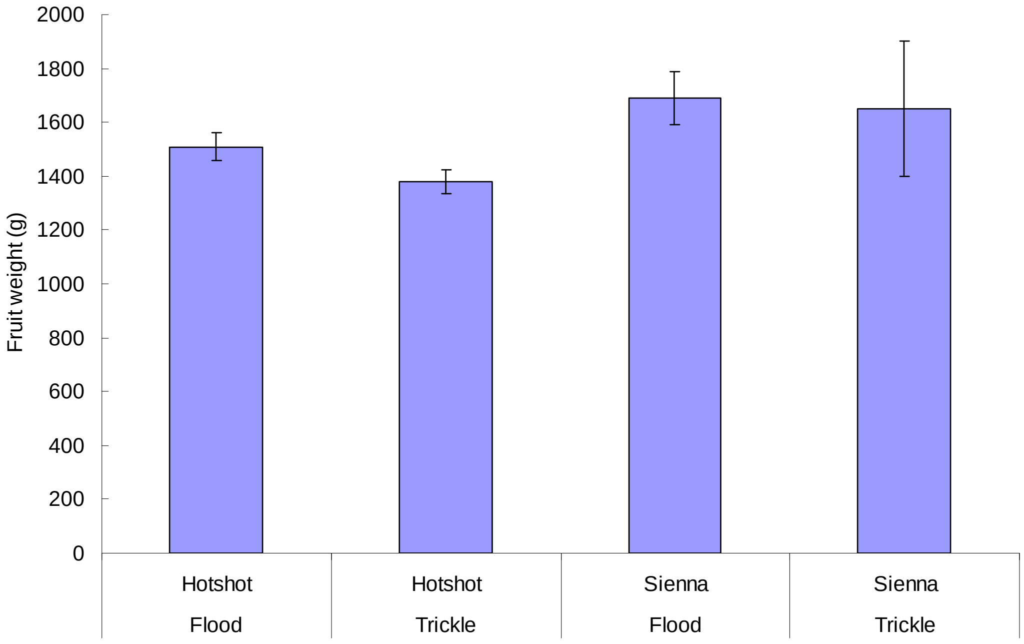


Figure 13. Individual weight of rockmelon fruit varieties Hotshot and Sienna grown on either trickle or flood (furrow) irrigation.

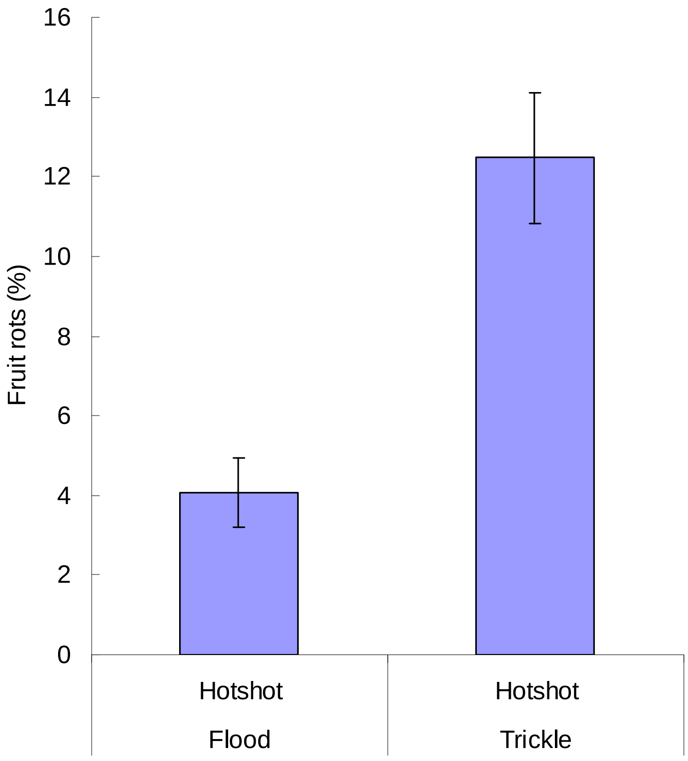


Figure 14. Percentage of rockmelon fruit rots for varieties Hotshot and Sienna (not included in graph) grown on either trickle or flood (furrow) irrigation.

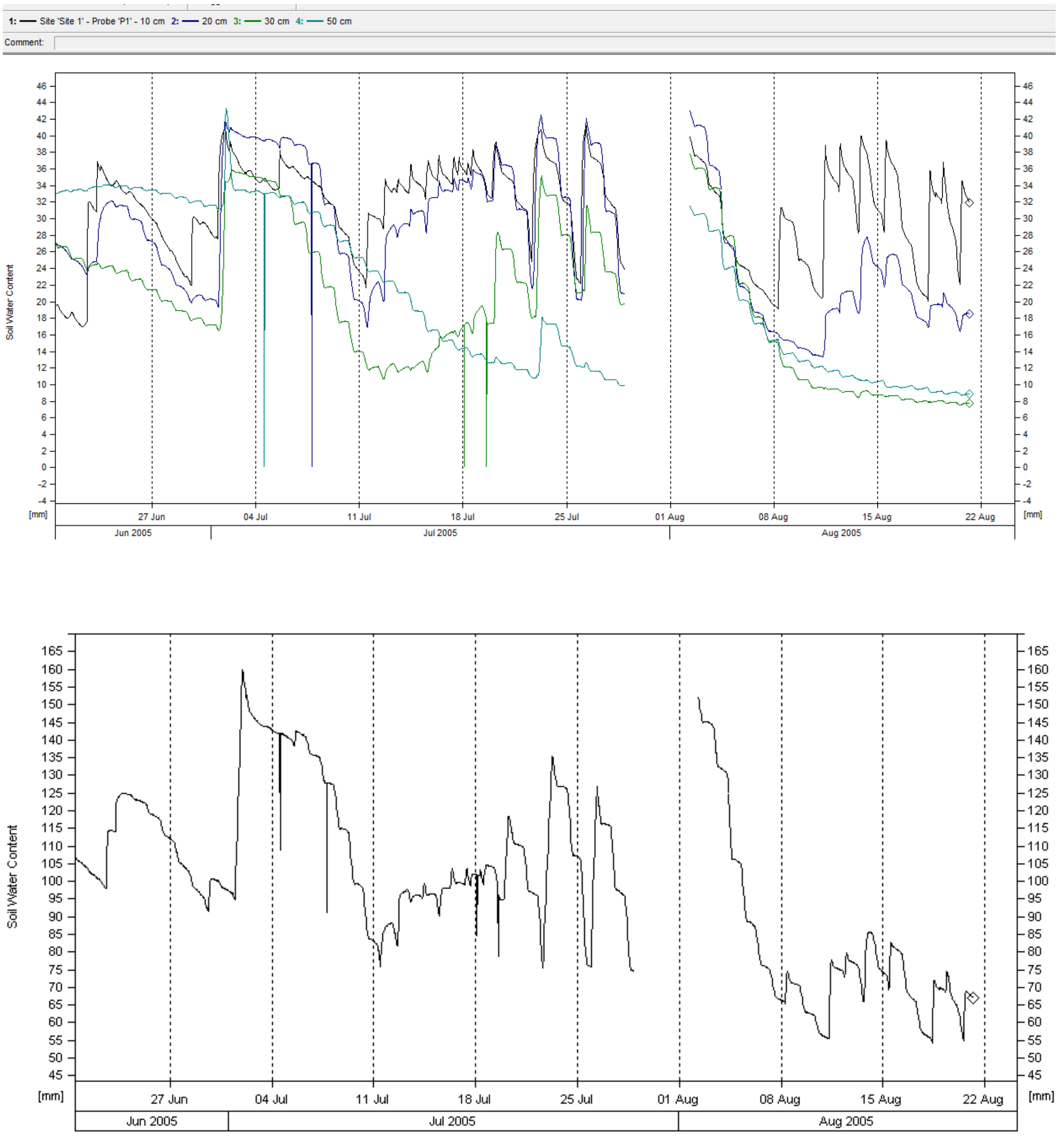
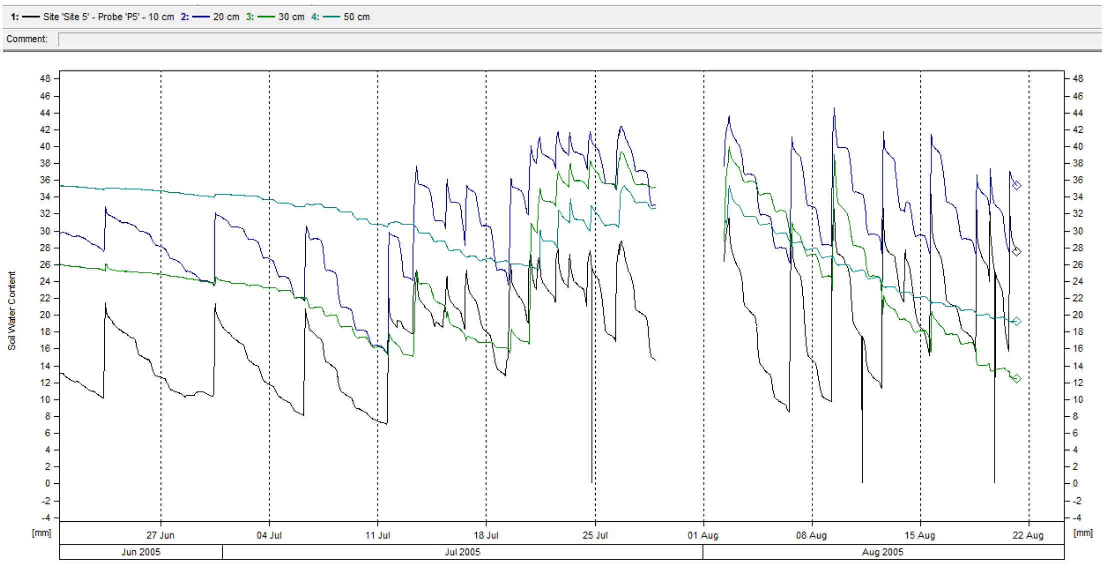


Figure 15. Planting 1 (cv. Hotshot): soil moisture levels. The top figure is the soil moisture at individual soil depths and the bottom figure is the total amount of water available in the top 50cm of soil.



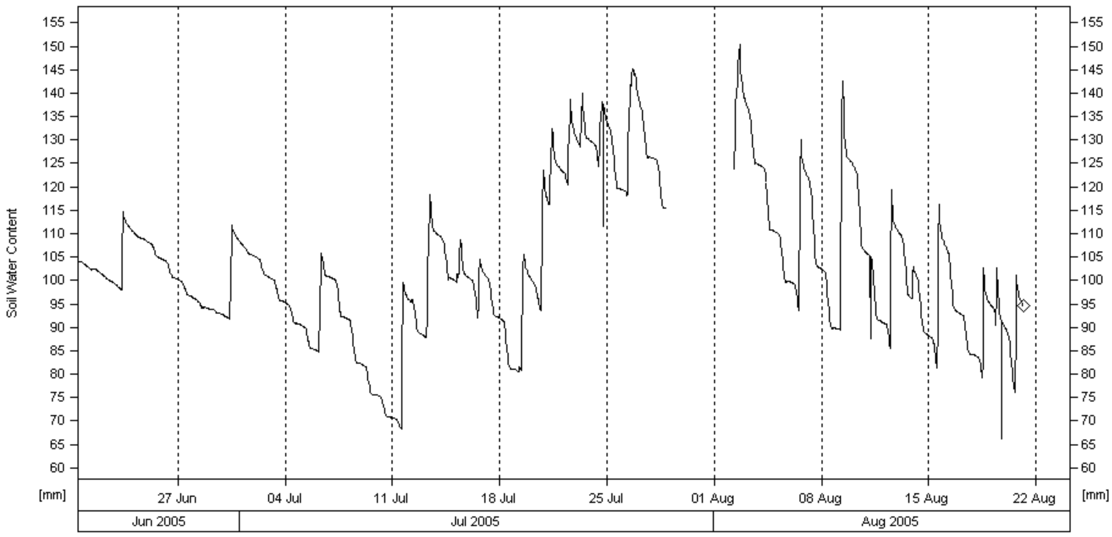


Figure 16. Planting 2 (cv. Sienna): soil moisture levels. The top figure is the soil moisture at individual soil depths and the bottom figure is the total amount of water available in the top 50cm of soil.

Fig. 17 Leaf Tissue Nutrient Levels: late fruit development.

PHOSYN ANALYTICAL

Phosyn Analytical, 1/60 Junction Road,
Andrews, Queensland 4220, Australia
Tel: +61 7 5568 8700, Fax: +61 7 5522 0720
email: phosynanalytical@phosyn.com

Analysis Results (LEAF)

Customer : DAVID MENZEL
KUNUNARRA

Distributor : APPLIED HORTICULTURE RESEARCH
PO BOX 538
PENNANT HILLS
NSW

Sample Ref : PLANTING 2 N/A
Sample No : B013643A / PE1459
Crop : ROCKMELON

Date Received : 29/08/05 (Date Sampled : 26/08/05)

Page Number
1 / 2

Analysis	Result	Guide	Interpretation	Comments
Nitrogen (%)	3.88	2.00	Normal	Nitrogen is important for crop and leaf quality. During periods of stress, e.g. drought, cold wet conditions, wind, etc apply TRACEL SP at 5 kg/ha.
Nitrate N (ppm)	294			
Phosphorus (%)	0.31	0.25	Normal	Phosphorus is a key nutrient for cell division and growth. Deficiency symptoms include severe stunting and the undersides of leaves are purple. Older leaves turn yellow and die prematurely. Level found is in the normal range.
Potassium (%)	3.44	1.50	Normal	Potassium is important for cell division and the function of chlorophyll and several enzymes. Level found is in the normal range.
Calcium (%)	6.72	2.00	High	Calcium is important for cell to cell adhesion and a deficiency can lead to reduced quality. Level found is high but not a problem for this nutrient.
Magnesium (%)	0.74	0.40	Normal	Magnesium is important for leaf and fruit quality. Check for deficiency symptoms, which include yellowing of the interveinal areas of the older leaves progressing to other leaves as deficiency worsens. Fruit can be lightened, soft and mature prematurely. Prevention of deficiency is far more effective than cure. Level found is in the normal range.
Sulphur (%)	0.78	0.25	Normal	Sulphur is important for photosynthesis. Level found is in the normal range.
Boron (ppm)	73.0	30.0	Normal	Boron is important for flowering and normal fruit development. Deficiency symptoms include poor fruit set and split miss-shaped fruit. Level found is in the normal range.
Copper (ppm)	5.3	7.0	Slightly Low	Low priority and treat only if deficiency symptoms are seen.

Date Printed : 1 Sep 2005

PHOSYN ANALYTICAL

Phosyn Analytical, 1/60 Junction Road,
Andrews, Queensland 4220, Australia
Tel: +61 7 5568 8700, Fax: +61 7 5522 0720
email: phosynanalytical@phosyn.com

Analysis Results (LEAF)

Sample Ref : PLANTING 2 N/A
Sample No : B013643A

Page Number
2 / 2

Analysis	Result	Guide	Interpretation	Comments
Iron (ppm)	173	120	Normal	Iron is important for chlorophyll formation and photosynthesis. Deficiency symptoms include yellowing to whitening of younger upper leaves. Level found is in the normal range.
Manganese (ppm)	179.0	40.0	High	Manganese is important for leaf quality. Level found is high and probably due to surface contamination from pesticide sprays.
Molybdenum (ppm)	<0.05	0.10	Low	Molybdenum is important for crop growth and development. Deficiency symptoms include slight interveinal yellowing of leaflets, which roll up. Apply MOLYTRAC at 250 ml/ha when plants are 15cm high.
Zinc (ppm)	90.0	30.0	Normal	Zinc is important for leaf development, flowering and fruit set. Deficiency symptoms include stunted plants with small rolled leaves. Mature leaves develop brown spots and wither. Plants can develop small flat fruit. Level found is in the normal range.
Sodium (%)	0.100	<0.500	Normal	Normal
Chloride (%)	2.69	< 1.00	High	High: undesirable suggest check water supply.

Additional Comments
ALWAYS READ THE LABEL BEFORE USING A PHOSYN PRODUCT

Date Printed : 1 Sep 2005

Extension

Kununurra: A field day was held for local growers on the 17th August 2005 to view the trials and discuss the work with the grower and AHR staff. Several growers attended, and given that the melon industry in Kununurra is made up of a very small number of large growers, this was a pleasing result.

Field Day – Chinchilla: A field day was held at Chinchilla, on Fred Turner's property. This was organised by the Australian Melon Association and the Chinchilla Melon Festival committee. Dr Rogers presented the results of the agronomic project to growers and industry people at the field day.

Presentations, Meetings, Seminars, Workshops and other Events

Presentation of results at the Australian Melon Conference, Townsville, 2005

Farm visits: Gary Amaros, Griffith, NSW and Andrew Young, Robinvale, Vic.

Field Day: Kununurra in June 2005