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Crimson seedless promise WA table grape boon

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Five years of research and development into growing Crimson Seedless table grapes in Western Australia has produced a product of international quality. Berry sizes are 20 per cent larger than those being exported by both California and other Australian States. Overall, Crimson Seedless is expected to provide enormous opportunities for Western Australia's table grape industry. Ian Cameron reports.

Crimson Seedless is a crisp, red, seedless variety of table grape that was initially bred in California and released to industry in Western Australia in 1996. Consumer demand far exceeds supply. Consumers in Thailand, Singapore, Europe and Australia are all reacting the same way – the more they get, the more they want.

Following its release, the Department of Agriculture identified Crimson Seedless as an ideal grape to complement the Redglobe table grape variety. It was Redglobe that had led to major expansion in table grape production in Western Australia throughout the 1990s. It is expected that Crimson Seedless will have a similar impact in the first decade of the new millennium.

A growing industry
The table grape industry in Western Australia grew rapidly from 1991 to 2001, with total production of table grapes increasing from 3,500 tonnes in 1991/92 to more than 6,000 tonnes in 2000/01. In the same period, exports had a ten-fold increase from 115 tonnes in 1992 to 1,125 tonnes in 2001 (see Figure 1).

The growth in exports is due to Redglobe being produced between early January and late April.
These grapes are being grown on vineyards between Northampton and Margaret River.

The value of table grape exports in 2001 was $3 million. Future growth in exports is expected to come from new varieties, with Crimson Seedless taking the leading role. New varieties will also be important for the domestic market, although export is being seen as the primary growth area.

**Crimson Seedless characteristics**

Crimson Seedless was bred by the United States Department of Agriculture and is expected to be the last significant new variety to be released without patent protection. The variety can be grown by any commercial grower in Western Australia, and cuttings or grafted vines are available from the Western Australian Vine Improvement Association or commercial nurseries.

The variety has many unusual features.

- It is harvested between late February and late March in all suitable regions. Most other varieties grown in warmer climates ripen earlier.
- It produces low yields of poor quality fruit when grown on its own roots. Vine vigour, yield and berry size improve significantly when grafted onto a vigorous rootstock.
- High night temperatures severely reduce colour development. Berry colour can vary from cherry red to black.
- It has crispness and skin characteristics that make it ideal for long-term cool storage. Crimson Seedless has been cool stored for up to six months with excellent results.
- Gibberellic acid cannot be used to increase berry size. Most other seedless varieties are treated with this plant hormone to produce a more attractive product.
- It is a high acid variety. The combination of high sugar levels with a background of acidity produces outstanding taste characteristics.
- Crimson Seedless tolerates rain at harvest. Most other seedless varieties split with rain.
Time of pruning is critical to yield, with early pruning resulting in low yields. No other table grape variety is as sensitive to time of pruning.

Research
Production techniques for Crimson Seedless were largely unknown when the variety was released to industry. Therefore, a 10 year development plan was initiated, with the objective of the research program being to develop management techniques to produce viable yields of the best quality Crimson Seedless table grapes in the world.

The first five years of the program have concentrated on identifying suitable production regions and soil types, evaluating the effects of rootstocks on yield and fruit quality, developing pruning methods, and investigating the storage life of the variety. Palatability studies have also been conducted to ensure only high quality, sweet grapes are placed on the market.

Over the next five years, production techniques will be refined to ensure maximum yields of high quality fruit are produced in all climatically suitable regions.

Production regions
Crimson Seedless is not recommended for early production areas such as Carnarvon or Wiluna due to low yields and poor fruit colour.

More favourably, the Mid West produces fruit that ripens in late February after the Redglobe crop has been harvested. This area is expected to be the first to produce Crimson Seedless in the State each season.

Major plantings are expected in the region from Gingin to Donnybrook, particularly in areas with good quality water and deep soils located within 30 kilometres of the coast.

Grapes produced south of Harvey will produce dark rather than bright red berries. This dark coloured fruit will be harder to sell in South East Asia.

Crimson Seedless should not be planted further south than Cowaramup or Donnybrook, because fruit is unlikely to develop the desired level of maturity to meet market requirements.

Suitable soils
Crimson Seedless must be grown on deep soils. The absolute minimum depth of top soil over clay subsoil is 40 centimetres. Large root volumes appear to be essential for vine vigour and fruit quality, with berry size being closely linked to soil depth.

In fact, berry growth studies with Crimson Seedless growing on a wide range of soil types established that soil depth started influencing berry size 20 days after flowering (see Figure 2). This reduced performance in shallower soils appeared unaffected by changes in irrigation or nutrition.

Soil type appeared to be less critical than soil depth, with excellent yields and quality achieved on low fertility sands, sandy loams, sand over clay, and gravel soils when nutritional deficiencies were corrected.
The relationship between soil type and fruit quality produced some surprising results. A vineyard planted on a low fertile sandy soil on the coastal plain west of Harvey produced outstanding yields of top quality fruit. In addition, the berry colour produced in this vineyard was recently voted by grape importers in Singapore and Thailand as the ideal colour required by the market.

Rootstocks
All commercial table grape vineyards in Western Australia are grown on nematode resistant rootstocks such as Ramsey and Schwarzmann. These two rootstocks are involved in 90 per cent of the plantings around the State and are used on a wide range of soil types growing a number of varieties.

The introduction of a new variety such as Crimson Seedless provided an opportunity to evaluate new rootstocks previously not grown in Western Australia. Rootstock trials were undertaken in Carnarvon, Wiluna, Northampton, Chapman Valley, Swan Valley, Baldivis, Waroona, Harvey and Donnybrook to determine which rootstock produced the highest yield of top quality fruit in each area. Rootstocks included Ruggeri 140, Paulsen 1103, Teleki 5C, 110 Richter, 99 Richter, K51-32, K51-40 and Kober 3BB, along with Ramsey and Schwarzmann and vines on their own roots.

After five years of data collection, it can be concluded that Crimson Seedless vines grafted to Ramsey or Schwarzmann rootstock perform well in all regions from the Mid West to Donnybrook. Crimson Seedless should not be grown on their own roots. Ramsey or K51-32 appeared to be better suited to deep sandy soils. Ruggeri 140 and 99 Richter produced large berries with a high packout of export quality fruit. However, these rootstocks were susceptible to nematode damage and should not be used on soils where horticultural crops have been produced in the past. Paulsen 1103 and Teleki 5C produced low export packouts.

In addition, grafted vines should be planted in rows 3.3 metres apart. Deep soils can be planted with 2.4 metres between neighbouring vines. Soils of marginal depth should be planted with 2.7 metres between vines. The rootstocks 99 Richter and 110 Richter appear to perform better with a wider planting distance.

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A further conclusion from the rootstock research has been that Crimson Seedless should not be grafted onto existing vines irrespective of rootstock or interstock. Grafting onto established vines of Redglobe, Calmeria, Sultana and Chardonnay produced satisfactory yields, but the grapes were poorly coloured at harvest.

Further research is needed to understand the processes involved as this problem has never been experienced with other varieties.

Vine management
Crimson Seedless is one of the most vigorous varieties of table grape in the world and early research in Western Australia aimed to reduce vine vigour through various means. However, this had an adverse effect on fruit quality. As a result, high vigour has been encouraged by splitting the vine canopy into two walls of foliage trained onto a 'Y' trellis.

Shoot topping during the growing season is essential if powdery mildew is to be controlled and the correct berry colour achieved at
Harvesting grapes in a Crimson Seedless rootstock trial.

harvest. Hedging of shoots is carried out after fruit set (early December) and again after colour change (January).

Cane pruning is also required to produce viable yields. The number of canes per vine varies according to the age and vigour of the vine.

Vines are usually trained onto the trellis in the year of planting or after field grafting. At the end of the first growing season, the pruned vine has only two short canes. This increases to 4 canes, 6 to 8 canes and 6 to 10 canes in subsequent years.

Mature vines should carry 25 to 45 bunches per vine each season, which means a marketable yield of 25 to 30 tonnes per hectare.

Time of harvest

The secret to successful marketing of table grapes is providing the customer with a sweet and tasty product that is uniform in appearance in terms of berry colour and size. The appearance of the grapes is critical in making the initial sale, but follow up trade will only occur if the fruit has the desired level of sweetness.

Grapes do not ripen after harvest. Therefore the time of harvest is crucial. Palatability studies have been conducted over the past four seasons to determine the minimum level of sweetness required to satisfy customer demand for Crimson Seedless.

The variety has a naturally high level of tartaric acid. This is the most common acid found in all grapes and levels above 7.5 grams per Litre are generally unacceptable to the human palate. As grapes ripen, the acidity falls and the sugar levels increase. Sugar content is easily measured by a refractometer and is recorded in degrees brix.
Crimson Seedless table grapes ready for harvesting.

Some countries determine minimum maturity levels in terms of the sugar to acid ratio. The palatability studies showed that a sugar to acid ratio of 30:1 satisfied at least 75 per cent of customers in most years. Consumer acceptance increased as both the sugar:acid ratio and brix increased. Based on these findings, in years of high acidity, Crimson Seedless should not be picked until the sugar level is above 21 brix. In a year of low acidity, the grapes may be very acceptable at 19.5 brix (see Table 1).

A refractometer is used to test sugar levels prior to harvest.

Cool storage

Crimson Seedless is one of the best table grape varieties for long-term storage. For instance, grapes picked in March can be sold in perfect condition from May to August when supplies of grapes in the market place are low and prices are high.

Although, to achieve long term storage, grapes must be picked at optimum maturity and rapidly cooled to remove field heat within six hours of harvest. They should then be packed inside a poly liner to ensure high humidity during storage to maintain stalk freshness.

Before closing the poly liner, a sulphur dioxide generator pad should be added to the top of the packed fruit. This pad gives off a steady but slow release of sulphur dioxide gas for 8 to 16 weeks. The gas stops the development of storage rots, provided fruit temperatures are maintained close to zero. Crimson Seedless grapes are not damaged by sulphur dioxide gas if the correct dosage is used.

Industry development

Early results with Crimson Seedless in Western Australia suggest the variety will be a winner, provided growers use the knowledge developed to date and are prepared to evaluate new techniques. Many of the standard techniques used on other varieties have been found not to work on Crimson Seedless.

Over 100 table grape growers had commercial plantings of Crimson Seedless in Western Australia in 2001 and that figure is expected to double in the next five years. To assist with industry growth, a production manual, initially produced in 1998 to advise growers of possible management techniques, has been updated to incorporate latest research findings. The revised manual is expected to be available in August 2001.

A Crimson Seedless Club has also been formed. This group is funding research into the importance of vine nutrition on berry size, berry colour and yield. The nutrition study will continue for another two years.

Crimson Seedless workshops will be held in all regions in August each year.

Table 1. Acceptability of Crimson Seedless table grapes at different levels of maturity.

<table>
<thead>
<tr>
<th>BRIX</th>
<th>ACIDITY</th>
<th>BRIX/ACID RATIO</th>
<th>% Tasters who rate grapes as acceptable</th>
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<tr>
<td>17.0</td>
<td>8.4</td>
<td>20:1</td>
<td>29%</td>
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<td>7.2</td>
<td>25:1</td>
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<td>6.6</td>
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<td>67%</td>
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<td>6.1</td>
<td>33:1</td>
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<tr>
<td>21.0</td>
<td>5.9</td>
<td>35:1</td>
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