Hort Innovation

Final Report

Australian Cherry Evaluation Utilizing Precocious Rootstocks

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Delivery partner:

Flavell Fruit Sales Pty Ltd

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CY12024

Project:

Australian Cherry Evaluation Utilizing Precocious Rootstocks – CY12024

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Content

Content 3
Summary 4
Public summary Erro r! Bookmark not defined.
Keywords 5
Introduction 6
Methodology 7
Outputs 9
Outcomes 10
Monitoring and evaluation 11
Recommendations 12
Refereed scientific publications 12
References
Intellectual property, commercialisation and confidentiality 13
Acknowledgements 14
Appendices 15

Summary

The Australian cherry industry currently grows many imported varieties that lack widespread adaptation to Australian climatic conditions, resulting in poor and inconsistent yields. Major quality and agronomic issues, including rain cracking susceptibility, small fruit size and softness, further constrain the ability of the industry to consistently deliver large quantities of high quality fruit to overseas and domestic markets.

The Australian Cherry Breeding Program (1995-2014) and its locally funded predecessor South Australian Cherry Breeding Program (1983-1994) conducted breeding activities targeted towards developing high quality Australian Sweet Cherry varieties for export and domestic markets; developing a range of unique genotypes displaying varied combinations of large fruit size, good fruit firmness, rain crack resistance, self-fertility and general adaptation to Australian conditions.

SARDI ceased breeding and evaluation actives at the former Lenswood Horticultural Research Centre in June 2014, leaving 115 lines requiring evaluation to determine their commercial potential. These lines and 11 common commercial comparator varieties to be used as biological indicators were grafted onto three rootstocks available to the Australian Cherry Industry. A standard full vigour rootstock (Mazzard F12/1) and two promising proprietary dwarfing precocious rootstocks, Giesla 6 (Grahams FacTree) and Krymsk 5 (ANFIC). These were then planted as bare rooted trees at a site in Lobethal, in the Adelaide Hills production region of South Australia in 2013.

This project aimed to progress the formal evaluation of the remaining lines and determine which are suitable to be commercialized, while providing recommendations on appropriate rootstock pairings for growers to obtain the best results from the varieties.

Far too many varieties, particularly those of international origin, are released to growers in Australia, for which there is insufficient information to answer even the basic questions about their performance in Australian sweet cherry growing systems. This information void often results in significant risk and financial costs to Australian growers when new varieties prove unsuitable.

Through this project we were able to establish and maintain the trial, gathering a good cropping season of bloom and fruit quality assessment data, sufficient to make culling recommendations on 46 of the 115 breeding lines. A further 69 lines continue in the trial, 8 of which are reported here as having excellent results during the 2017/18 season. Lines LA6.51, KS1.7, LA3.57, EB1.86, EB1.176 and FVB5.39 are dark cherries, L8.202 and EB1.95 are white or blushed cherries.

During the 207/18 harvest season field walks were conducted so growers could see first-hand bloom and the cropping and fruit quality of the lines with fruit on trees. This resulted in the ordering of semi commercial quantities of 6 lines. These trees will be available to plant winter 2019, protected by non-propagation and testing agreement.

A further 3-4 seasons is required to fully evaluate the lines that remain, identify the top performers and provide further surety as to consistent seasonal performance.

Keywords

Sweet Cherry; new varieties; variety evaluation; rootstocks; fruit quality

Introduction

The Australian cherry industry currently grows many imported varieties that lack widespread adaptation to Australian climatic conditions, resulting in poor and inconsistent yields. Major quality and agronomic issues, including rain cracking susceptibility, small fruit size and softness, further constrain the ability of the industry to consistently deliver large quantities of high quality fruit to overseas and domestic markets.

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Methodology

The objective of this project was to take the remaining germplasm developed by the former Australian Cherry Breeding Program (1995-2014) and its locally funded predecessor the South Australian Cherry Breeding Program (1983-1994), incorporate it into an evaluation trial and evaluate it on precocious rootstocks. Thus, identifying and unlocking its commercial value for Australian cherry growers. The timelines to perform these activities in a perennial tree crop system, such as sweet cherry are long. This meant that in the five-year project time frame, only trail establishment and one or two seasons of evaluation trial data was realistically possible.

Note that to fully complete the process from trial inception, through evaluation and commercialization, eight to nine years would be a likely completion timeframe.

To begin with, 115 breeding lines of interest were available to be evaluated, and a further 11 commonly grown commercial cultivars were chosen and added as comparators or biological benchmarks. It was also decided to perform the evaluations on an expanded suit of new and precocious rootstocks that have recently become available to the Australian industry, increasing the knowledge of both the new varieties and the rootstocks under Australian conditions and providing performance data and suitability recommendations to growers.

Three rootstocks were used.

- Mazzard F12/1: The most widely grown, vigorous and least precocious non-dwarfing rootstock, was used as the industry standard comparator.

As well as with the main proprietary precocious dwarfing cherry rootstock from two major competing nursery groups.

- Giesla 6 (Grahams FacTree)
- Krymsk 5 (ANFIC)

This project sought to identify-:

1. What lines are likely to be commercially viable, what has breeding value and what should be discarded?
2. If a line has value, is it better on a precocious rootstock or can any nursery produce it on a non-proprietary standard non-dwarfing stock?
3. If a line requires a precocious stock then are there advantages in a particular rootstock?

In an attempt to reduce time from establishment to cropping, stocks were purchased, bench grafted and planted directly into the trial, saving a year that would normally be spent in a field nursery before bare rooted grafted trees were planted. The results of this approach were disappointing due to the supplied Mazzard and Gielsa 6 (G6) rootstocks being devoid of both structural and feeder roots and the trial environment being a harsher environment in which to establish trees than a carefully prepared and managed field nursery. The ability to plant rootstocks and get them established and growing before grafting is a major advantage in achieving good grafting success rates. This decision to try and speed up the process was not as successful as hoped and required extra effort to rectify.

Dormant bud-wood of the lines to be grafted was collected from Lenswood Research Centre and stored in humidified plastic bags at 2C. 900 dormant rootstock trees, (300 of each rootstock type) were procured from participating commercial nurseries and stored in bins of moist sawdust in the Lenswood Coldstores. Grafting sessions were held to top graft two rootstocks of each type to each cherry line. These were again sealed in humidified bins and stored in the Lenswood Coldstores.

Grafted trees were planted at Flavell's trial site by tree planter and the trial site was mapped and a Microsoft Excel template prepared for collecting future observations. Regrowth was removed from the rootstocks to encourage growth of the scion in late spring and again in summer. In autumn, success rates were determined by recording whether individual trees were: (1) successfully grafted and growing, (2) rootsock alive but graft unsuccessful, (3) dead.

Throughout the trial period, during each autumn, growing but unsuccessfully grafted rootstocks were re-grafted by T-budding. Further rootstocks were purchased when required in winter and re-grafted by whip and tongue method in early spring to make up missing trees in an attempt to get the entire trial plan as complete as possible. Summer 2014/15 was hot and dry and water was in short supply at the trial site and became increasingly saline. This also had an effect on delaying and reducing establishment of the trial. Fortunately, the following winter was rather wet

and able to leach accumulated salts, providing some relief.

By summer 2016/17 the trial was substantially developed and cropping was beginning, one season behind predicted schedule. The decision was made by the project management committee to not drape net the trial and begin the collection of data for several reasons. Only approximately 25% of trees carried bloom and universally poor fruit set rates were being experienced throughout the Adelaide Hills. With a very light crop likely it would not be cost effective to bird net for a limited number of results. Many of the trees were also small due to the use of precocious dwarfing rootstocks. It was feared drape net would unduly compromise small trees without sufficient structure to support its weight, leading to issues of tree development later. Extra effort was instead put into tree training, grafting and getting the trial as even and complete in its composition as possible for the next season.

In spring 2017/18 post and wire supports were added to each trial row to support drape net and alleviate tree damage. Each tree was given an individual trunk label showing its individual tree identification number, line name and rootstock to facilitate navigation and data collection. Full bloom date and density of bloom was then recorded for all trees. Drape net was applied to protect the crop at the beginning of November.

Fruit underwent preliminary assessment on each individual tree at intervals of no more than seven days during harvest. Harvest dates were assigned at maturity and a quick assessment of fruit quality made. Lines deemed to be not of sufficient standard then received a short assessment where crop level, average fruit weight, firmness and colour was recorded in the field. These trees usually display excessively small or unsound fruit due to softness or rain cracking, which were recorded as field rejects of no commercial value.

Individual trees judged to have met basic minimum standards of fruit size and soundness had a sub-sample harvested and subjected to an extended laboratory assessment. Laboratory assessments measured the quality parameters of average weight, fruit shape, damage type, total soluble solids (Brix), flavour profile, eating quality and stem characters, along with a comment of the examiners overall perception of the sample. Firmness was initially recorded as a subjective measure in the categories soft, intermediate, firm and very firm corresponding with the international cherry descriptors. Following this assessment fruit firmness was also measured quantitatively using a FirmTech2 machine before fruit was photographed in various profiles for later reference.

At the completion of harvest all assessment results were grouped, reviewed and decisions made as to the future of the line within the trial. Where lines were consistent in the expression of particular negative traits such as small size or softness across more than two different rootstocks they could be confidently categorized and rejected. Decisions on single or low number observation were avoided preferring to collect another season’s data before making determinations. In this manner 47 of the 115 lines were rejected on the 2017/18 season data.

Grower field walks were also held during winter, bloom and harvest in late 2017, to show case the trial and promote the better performing varieties through viewing fruit on trees.

Outputs

This project aimed to progress the formal evaluation of the remaining lines and determine which are suitable to be commercialized while providing recommendations on appropriate rootstock pairings for growers to obtain best results.

Its target outputs were to produce information to:

- Contribute to, and enable the condensing and targeting of further evaluation activities
- Identify high quality new varieties adapted to Australian conditions to support the Australian Cherry industries objectives in domestic and export markets.
- Reduce the risks to growers involved in developing new production systems involving new varieties.
- Provide more variety choice to growers to improve both fruit quality and fill production gaps
- Increase overall fruit quality for markets
- Potentially help developed new market segments such as white/blushed cherries which makes up approximately 15% of the American market but is relatively unknown in Australia

CY12024 was able to set up the trial block and obtain a first season of evaluations recommending the discontinuation of 46 lines with six lines impressing sufficiently to be grafted for semi-commercial scale evaluation by 3 growers.

Information on 8 lines representing the most consistent and best performing lines of the season are reported in the Appendix.

Outcomes

CY12024 was able to set up the trial block and obtain a first season of evaluations recommending the discontinuation of 46 lines with six lines impressing sufficiently to be grafted for semi-commercial scale evaluation by 3 growers.

Information on 8 lines representing the most consistent and best performing lines of the season are reported here.

Due to the significant time lines involved in perennial tree crop evaluation it was unrealistic that this project could complete the evaluation and commercializion of the remaining Australian Sweet Cherry Breeding Program's germplasm. This is a task that would normally require a minimum 8 to 9 years, clearly not achievable in the 5 year time frame of this project.

However, this project has identified 46 lines that can be removed enabling a greater focus on the 69 that remain, making the ongoing tasks that need to be completed less time consuming and cheaper. It has also identified 8 early performing lines that may be worthy of closer scrutiny going forward.

These are LA6.51, KS1.7, LA3.57, EB1.86, EB1.176 and FVB5.39 (dark cherries), L8.202 and EB1.95 (white or blushed cherries). This information is giving proactive growers the opportunity to trial the new lines in their own enterprise, an opportunity that three growers have so far taken up. More information on the individual lines is available in the Appendix.

Monitoring and evaluation

This research agreement was originally contracted in 2013 and as such was never formulated with a formal M&E Plan.

Elements within the project that would have likely formed part of an M&E Plan are the Deed of Novation & indemnity enacted by Hort Innovation in December 2015 and use of a Project Management Committee (PMC) which met regularly over the life of the project to review progress and was actively involved in the decision making towards outputs.

The project management committee met informally as part of the Cherry Gowers SA executive at meetings several times a year over the life of the project. All field work was largely completed by the project leader and Cherry Gowers SA, President A. Flavell, with field workshops when required supported by N. Noske, D. Graetz, I. Sparnon, D. Leonard, S.Cornish, T. Hannaford, G. Wotton, S. Green and industry horticultural consultant B. Thomas.

The PMC accepted the verbal reports and presentations from the recommended expert D. Graetz detailing the evaluation process and criteria being used, endorsing culling and advancement recommendations that were made at meetings.

The final group workshop to setup and maintain the trial was held 29/9/17 and attended by six Cherry Growers SA Association members.

A Cherry Growers SA member's grower walk of the trial to view fruit on trees was held 12/12/17 and stored fruit was shown at the 2017/18 post-harvest meeting (30/1/18). Regular updates were provided to pre and post-harvest meetings of Cherry Growers SA each season.

In 2016 as part of the Australian Cherry industry communications package (HIAL project CY15002) delivered by Coretext, project leader, trial manager and Cherry Growers South Australia president Andrew Flavell and recommended expert Darren Graetz took part in the production of a video about the project featuring footage of the trial. The video was produced and edited by Tom Bicknell (Coretext) and has been posted on the Cherry Growers Australia website.

All milestones pertaining to this project have been completed and accepted by HIA.

Recommendations

It is recommended that:

- Either a new project be funded or an extension be sought for a further 3 to 4 year period complete the work this project CY12024 has begun.
- Evaluation continue to further distil the potential that exists within the Australian Sweet Cherry Breeding Program's and identify new varieties to benefit the Australian Cherry industry
- That culling continues annually to allow more resources to focus on the potential new varieties showing the most promise.
- Information continue to be collected to be collated into Grower Information sheets to support and promote the commercialization of new varieties and better inform Australian cherry growers.

It should be noted that if continued evaluation shows that a particular line and stock combination is beneficial, it is likely to be prudent to commercialize in partnership with the nursery that holds the rights to that stock.

Refereed scientific publications

Nil

Intellectual property, commercialisation and confidentiality

No project IP, project outputs, commercialisation or confidentiality issues to report

Acknowledgements

Cherry Growers SA wishes to acknowledge the dedication and support of the following members in the progress of this project A. Flavell, N. Noske, D. Graetz, I. Sparnon, D. Leonard, S.Cornish, T. Hannaford, G. Wotton, S. Green and B. Thomas

Appendices

Trial establishment

Previous milestones have focused heavily on trial establishment so it's not proposed to reiterate that here. However it is important to acknowledge a few major points.

- If taking the calculated risk of trying to establish trials involving newly grafted trees directly into the field to save lead time, nurseries need to supply rootstocks with root systems attached that are sufficient to support both the rootstock and scion development. Less root pruning will also reduce the high number of injury sites for potential infection by other pathogens, reducing mortality. The trial site should also be as free of competition from weeds and well-watered with a quality water source as possible. Due to these factors, if time permits it is probably best to plant strong, bare rooted grafted trees allowed to develop normally in a purpose-built field nursery where possible.
- Krymsk 5 displays a hypersensitive response to several common plant viruses. This manifests itself as complete death of both the rootstock and scion where virus infected scion grafting material is used. This proved not to be a significant issue in this trial indicating a general level of good phytosanitary health in the scion material to be tested. There were 8 lines that we were not able to establish on Krymsk 5 indicating the scion material may be carrying an undetermined virus.
- Krymsk 5 is of lower vigor than Mazzard but higher than Giesla 6 and at this particular trial site often seemed visually to be a better balance of vigor and precocity than either of the other stocks for many of the cherry lines tested.
- Giesla 6 rootstocks arrived heavily root pruned and displayed low grafting success rates, elevated death rate or failure of even rootstock alone to establish, which may indicate inherent sensitivities or a lack of robustness with this particular rootstock. Some care may be advisable if using this rootstock in replant situations.
- Mazzard rootstocks also arrived heavily root pruned. It displayed low grafting success rates and an elevated death rate or failure of even rootstock alone. Without feeder roots and having many wound sites for other infections, use in replant situations is not advised until these have been grown out and replaced or healed as establishment is likely to be problematic. Mazzard also seemed more sensitive to the use of saline irrigation water than Gielsa 6 or Krymsk 5, however this observation requires more investigation.

2017/18 Season Assessment results

High winter chill, a low previous season crop season and dry bloom period saw a strong bloom period, good crop set and ultimately pleasing crop loads at this stage of the trees development. Full bloom dates and a rating of bloom density were recorded for all flowering trees. The trial was fully netted to protect the fruit from bird predation and trees individually trunk labelled for clear identification

Fruit underwent preliminary assessment on each individual tree at intervals of no more than seven days during harvest. Harvest dates were assigned at maturity and a quick assessment of fruit quality made. Lines deemed to be not of sufficient standard then received an abbreviated assessment where crop level, average fruit weight, firmness and colour was recorded in the field. These trees usually display excessively small or unsound fruit due to softness or rain cracking and are recorded as field rejects of no commercial value.

Individual trees judged to have met basic minimum standards of fruit size and soundness had a sub-sample harvested and subjected to an extended assessment in the laboratory. Laboratory assessment measured the quality parameters of average weight, fruit shape, damage type, total soluble solids (Brix), flavour profile, eating quality and stem characters, along with a comment of the examiners overall perception of the sample. Firmness was initially a subjective measure in the categories soft, intermediate, firm and very firm corresponding with the international cherry descriptors. Following this assessment fruit firmness was also measured quantitatively using a FirmTech2 machine before fruit from the sample was photographed in various profiles for later reference.

At the completion of harvest all assessment results were grouped, reviewed and decisions made as to the future of the line within the trial. The trial contains a potential 756 trees, 115 breeding lines and 11 comparator varieties on three rootstocks (two trees of each). In the 2017/18 harvest season assessments were gained from 544 trees, 204 were judged to be poor, 235 were satisfactory and 105 good. Ultimately the results for each line by rootstock were averaged and regraded. This regrading was used to decide whether the lines progressed (69, excluding the 11

comparators), were rejected (46, see Table 1) or were of consistently high quality on a range of rootstocks to be reportable this season (8, see Table 2).

The 69 lines which continue will not be reported here further as the quantum of data is both large and at this stage of negligible interest, as it is either insufficient or too inconsistent to confidently allow further categorization of the specific line at this stage.

Where lines were consistent in the expression of particular negative traits such as mall size or softness across more than two different rootstocks they could be confidently categorized and rejected. Decisions on single or low number observation were avoided, preferring to collect another season's data before making determinations. In this manner 46 of the 115 lines were rejected on the basis of 2017/18 seasons data. Rejected lines will be eliminated from the trial, Table 1 contains a list of eliminated lines.

Table 1. List of lines eliminated on 2018 data

EB3.1	FMB3.2	KS11.72	KS6.96	L4.195	LA2.26	LB14.45
EB4.73	FMB3.56	KS2.38	KS8.25	L5.120	LA4.70	LB7.22
EB5.30	FMB8.33	KS2.7	KS8.50	L5.51	LA4.87	LC1.125
EB5.44	FVB3.53	KS3.47	KSS4.15	L8.83	LA7.144	LC3.103
FB12.13	FVB5.55	KS5.22	KSS4.38	LA1.101	LB10.34	
FB13.44	FVB7.45	KS5.71	KSS5.17	LA1.37	LB10.40	
FB7.52	KS1.23	KS5.92	KSS6.13	LA2.111	LB13.37	

Table 2 shows the performance of six of the best dark cherries this season and two white or blushed lines with the data of four relevant comparators. The Lobethal trial site is considered a late harvest area by Adelaide hills standards, and as several of the lines are early to mid-season, this needs to be taken into account. It is also important to view all the new line information through the lens of the comparator data as they are known varieties and the trial was not treated with gibberellic acid (GA) or any other quality enhancing chemicals that a grower may commercially use.

It was particularly encouraging to note that all eight lines that showed out this season were either previously rated as tier 2 or 3 prospects by the breeding program on the seedling parent trees. As more data comes to hand in future years it is likely more will be uncovered as numerous tier 1 lines have yet to present sufficient compelling evidence in this trial. The best performing lines of 2017/18 were LA6.51, KS1.7, LA3.57, EB1.86, EB1.176 and FVB5.39 (dark cherries), L8.202 and EB1.95 (white or blushed cherries). More information on the best performed lines can be found following Table 2 with accompanying pictures (Figures 1-16).

Lines LA6.51, KS1.7, LA3.57, EB1.86, L8.202 and EB1.95 have, after grower field walks and fruit show viewings, been grafted by three growers for semi-commercial trialing. These trees will be available to plant winter 2019 and protected by non-propagation and testing agreements.

Table 2: Best performed Lines of 2017/18 with comparator data

Line	Stock	Harvest Date	Crop	Size (g/fruit)	Size (mm)	Brix	Firm Av.	Firm Max.	Rating	Comment
DARK CHERRIES										
LA6.51	G6	12-Dec	VH	9.9	28	17.2	291	390	Good	Firm, nice looking, good stems
	K5	5-Dec	MH	10.5	30	21.4	397	459	Good	Firm with crispness
	Mazz	12-Dec	MH	10.6	30	22.9	363	427	Good	Firm with a bit of tang
KS1.7	G6	12-Dec	M	9	28	25.8	439	597	Good	Good stems, crunchy, great taste
	K5	5-Dec	M	9.6	28	21.6	435	610	Good	Short stems, crunchy, good taste, not acidic
	Mazz	12-Dec	M	9.1	28	22.3	299	512	Good	Crunchy, very nice flavour, some side cracks
LA3.57	G6	12-Dec	M	10.5	30	18.9	430	533	Good	Reddish, size, firmness, robust, no cracks
	K5	17-Dec	M	11.2	32	19.6	494	581	Good	Super firm, big, flavour Ok with solid stems
	Mazz	23-Dec	H	10.4	30	23.5	368	502	Good	Has crop, firmness, size & balanced taste
EB1.86	G6	17-Dec	M	10	30	22.9	434	547	Good	Very firm, has some size, nice taste
	Mazz	12-Dec	M	10.8	32	21.7	487	542	Good	Large (>32mm), very firm, thin medium stems, nice taste
EB1.176	G6	23-Dec	H	12.3	32	26.2	294	352	Good	Heavy crop, very large, firm, nice stems and taste
	K5	23-Dec	VH	11.9	32	21.4	328	420	Good	Large size, Ok firmness on a very heavy crop, low acid taste
	Mazz	23-Dec	L	12.3	32	20.7	304	402	Ok	Clean, some firmness, great size, needs more crop
FVB5.39	G6	30-Dec	LM	10.4	30	24.1	301	421	Ok	Very long stems, over-mature, Ok flavour
	K5	30-Dec	H	11.6	32	24.7	288	417	Good	Very long thick stems are only real issue
	Mazz	30-Dec	H	11	30	21.6	387	481	Good	Long thin stems are only issue
WHITE CHERRIES										
L8.202	K5	12-Dec	VH	9.6	34	21.4	471	564	Good	Low acid, very firm, VH crop, med stem, to 14.2g
	Mazz	12-Dec	H	8.5	28	20.4	424	491	Good	H crop, size down, crunchy, low acid, sl. ring crack
EB1.95	G6	12-Dec	VH	12.6	32	18.1	320	405	Good	Big crop, large and firm, not acidic
	K5	17-Dec	MH	12.9	34	19.7	327	393	Good	Large, firm, not acidic, may crack
	Mazz	17-Dec	MH	11.7	32	22.3	336	440	Good	Large, firm, sl. nose cracking, low acidity
COMPARITORS										
Merchant	K5	5-Dec	M	11.8	32	23.5	264		Ok	Softish, ring cracks a bit, over-ripe
Stella	G6	12-Jan	VH	9	28	18.9	237	287	Ok	VH crop, softish, Ok taste, stems thin
	K5	12-Jan	MH	9.3	28	21.6	245	294	Ok	Acidic, softish, thin stems, sl. cracking
	Mazz	12-Jan	VH	9.4	28	21.1	218	268	Ok	Softish, thin stems, huge crop
Lapins	G6	30-Dec	L	9.6	28	22.4	362	411	Ok	Ok but needs crop
	K5	30-Dec	MH	10.5	30	21.4	334	425	Good	Solid with odd nose crack
Simone	G6	5-Jan	VH	7.7	26	20.7	357	408	Ok	Over-cropped but firm and clean
	K5	30-Dec	H	10.5	30	22.2	325	393	Good	Solid cherry with odd nose crack

Legend: Line=line number; Stock= Rootstock; Crop= Crop load (L=light, LM=light moderate, M=moderate, MH=moderately heavy, H=heavy, VH=very heavy); Size (g/fruit)= Average size grams per fruit; Size (mm)=Maximum size per fruit in mm; Brix=average brix; Firm Av.=Average firmness (g/cm^2); Firm max.= maximum firmness (g/cm^2)

LA6.51 (Full Bloom 4th Oct)

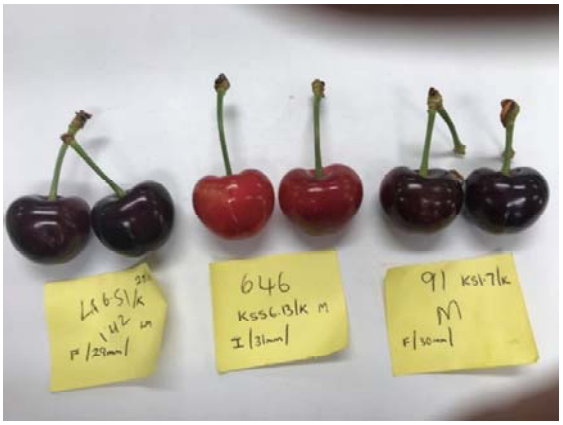
LA6.61 has shown good cropping, excellent size and very good firmness. It has a classic kidney shape and a short to medium stem of medium thickness which behaves quite robustly. Texture is crisp and flavor good, Giesla 6 (G6) and mazzard had some slight acidity not evident with Krymsk 5 (K5). G6 and Mazzard trees were picked 12th December 2017 which was a hot period reducing firmness. G6 also carried a very heavy (VH) crop which would have further reduced firmness and brix. LA6.51 looks to be an excellent cropper, which may require some management on G6. The result of two proven solid cropping mid to late season parents, the early harvest period comes as something of a surprise. Breeding program seedling results on limited observations suggested a harvest time of 4th December with good size (27mm) and firmness (454g/cm^2). Previously rated a 2nd tier selection from the breeding program its performance highlights the difficulty in rating performance on the basis of a single plant seedling selection. This is a really pleasing result indicating significant hidden value still lies in the Australian bred material. Figure 1 shows LA6.51 fruit harvested from a K5 tree on 5th December 2017 with fruit harvested 28th November 2017 is shown on the left in Figure 4. Figure 2 shows LA6.51 fruit on a G6 tree on 5th December 2017.

Figures 1 & 2

KS1.7 (Full Bloom 2nd Oct)

KS1.7 showed a nice moderate cropping start on all rootstocks, good size and excellent firmness with levels generally over 400g/cm^2. The fruit has a classic kidney shape with short thick very robust stems. Texture is crunchy and flavor excellent, sweet with low acidity. Mazzard trees showed some issues not evident on G6 or K5 in that when harvested after hot weather such as 12 Dec 2017 firmness took time to recover and fruit also had some slight side cracking, this needs to be further investigated but may only be localized and not stock related. Breeding program seedling results on limited observations suggested a harvest time of 4th December with good size (27mm) and some firmness (299g/cm^2). Previously rated a 3nd tier selection from the breeding program its improved performance in both size and firmness over the seedling is a really pleasing result. Figure 3 shows KS1.7 fruit harvested from a G6 tree on 12th December 2017. Figure 4 shows LA6.51 fruit from a G6 tree on the left and KS1.7 fruit from a K5 tree on the right harvested on 28th November 2017.

Figures 3 & 4



LA3.57 (Full Bloom 6th Oct)

LA3.57 showed a nice moderate cropping start on G6 and K5 rootstock, and surprisingly a heavy cropping start on Mazzard, the least precocious stock. Fruit size and firmness were excellent with firmness levels generally averaging over 400g/cm^2. Fruit has a classic kidney shape with medium length stem of medium thickness which behaves quite robustly. Texture is crunchy and flavor good, balanced and sweet. G6 trees were the earliest harvested on 12th December 2017, with the lowest average TSS (18.9 brix), it was noted at the time the colour was reddish but the fruit seemed mature. Importantly it was also noted as showing no signs of cracking. Mazzard trees harvested 23rd December 2017 were probably over mature, showing reductions in firmness levels (368 g/cm^2) and high brix levels (23.5 brix). Breeding program seedling results on limited observations suggested a harvest time of 4th December with good size (27mm) and firmness (454g/cm^2). Previously rated a 2nd tier selection from the breeding program its improved performance in both size and cropping over the seedling also partially explains the delay in maturity. Figures 5 & 6 show LA3.57 fruit harvested from K5 trees on 17th December 2017.

Figures 5 & 6

EB1.86 (Full Bloom 5th Oct)

EB1.86 showed a nice moderate cropping start on G6 and Mazzard rootstock. We have been unable to establish this line on K5 and see hypersensitivity and death in young grafted rootstocks so it likely has a virus infecting the line. Fruit size and firmness were excellent with firmness levels averaging over 400g/cm^2. Fruit has a classic kidney shape and a medium length stem of medium thickness which behaves quite robustly. Texture is crunchy and flavor good, balanced and sweet. G6 trees were surprisingly the latest harvested on 17th December 2017, with the highest average TSS (22.9 brix), it was noted at the time the colour was reddish but the fruit seemed mature. Importantly it was also noted as showing no signs of cracking. Mazzard trees harvested 12th December 2017 were probably also over mature by brix (21.7) but still showed excellent firmness levels (487g/cm^2) and a reddishness to the fruit. Fruit from these trees reached greater than 32mm size. Breeding program seedling results on limited observations suggested a harvest time of 17th December with good size (31mm) and firmness (438g/cm^2). Previously rated a 3nd tier selection from the breeding program its seedling also never showed any signs of cracking. Figures 7 & 8 show EB1.86 fruit harvested from G6 trees on 17th December 2017 and growing on mazzard trees 5th December 2017 respectively.

Figures 7 & 8

EB1.176 (Full Bloom 6th Oct G6, 9th Oct K5, 13th Oct Mazzard)

EB1.176 demonstrated variable cropping, heavy on G5, very heavy on K5 and light on mazzard. Size was excellent being very large and firmness reasonable averaging around 300 g/cm^2, naturally being capable of reaching over 400 g/cm^2. Fruit has a clean appearance and a cordate shape with medium to long stems of medium thickness which behave quite robustly. Texture is firm and flavor good with a sweet, low acid profile. All stocks performed similarly in most fruit characters. An open pollinated progeny of Van its shape indicates an outcrossing rather than a selfing mode of breeding, it has retained the low acid flavor profile of Van. Breeding program seedling results of two observations before the seedling was unfortunately removed suggested little more than a harvest time of 10th December with large fruit size and some firmness. A speculative save it was previously rated only a 3nd tier selection. Figure 9 shows EB1.176 fruit harvested from a Mazzard tree on 23rd December 2017. Figure 10 shows EB1.176 fruit on a K5 tree on 23rd December 2017.

Figures 9 & 10

FVB5.39 (Full Bloom 15th Oct)

FVB5.39 demonstrated variable cropping, light moderate on G5 and heavy on K5 and mazzard. Size was excellent being very large and firmness reasonable, averaging around 300 g/cm^2, naturally being capable of reaching over 400 g/cm^2. Fruit has a clean appearance and a cordate shape with very long stems of a generally thick robust nature. Stems on mazzard did seem thinner than the other stocks. Stem length may be seen as an issue but given they are no worse than Kordia which is a popular known variety they haven't been marked unduly harshly at this stage. Texture is firm and flavor good with a sweet moderate acid profile. All stocks performed similarly in most fruit characters, however all were probably over-mature when harvested 30th December 2017. Previous breeding program seedling experience with the seedling suggested a harvest time of 25th December with large 28mm fruit size and good firmness (432g/cm^2). Previously rated only a 3nd tier selection improved size and cropping give it some prospects. Figure 11 &12 shows FVB5.39 fruit harvested from a Mazzard tree on 30thDecember 2017.

Figures 11 & 12

L8.202 (Full Bloom 7th Oct)

L8.202 showed an excellent start to cropping with very heavy crops on K5 and heavy crops on Mazzard rootstock. We have struggled to get this to establish on G6 and currently don't have any cropping trees on this stock. Fruit size is good considering the large crops and firmness excellent with firmness levels generally averaging over 400g/cm^2. Fruit has a good classic kidney shape, medium length stems of medium thickness which behave quite robustly. Texture is crunchy and flavor good, low acidity and sweet. K5 and mazzard trees were harvested on 12th December 2017, consistent with differences in crop loads and brix. Fruit was increasingly blushed with increasing exposure of fruit and can be completely blushed. Some ring cracking was noticed on mazzard. On both K5 and Mazzard fruit was clumped reducing size with heavy crops however better spaced fruit on K5 achieved 14.2g (32mm) indicating significant improvements in size improvements are possible. Fruit handled very well in hot conditions with little marking. Breeding program seedling results on two moderately cropped observations suggested a harvest time of 10th December with good size (27mm) and firmness (444g/cm^2). Previously rated a 2nd tier selection from the breeding program its improved performance in both size and cropping over the seedling are impressive. Figures 13 & 14 show L8.202 fruit harvested from K5 trees on 12th December 2017.

Figures 13 & 14

EB1.95 (Full Bloom 10th Oct)

EB1.95 has shown good early cropping, very heavy on G6 and moderately heavy on both K5 and Mazzard. Size is excellent for crop, to 32mm on both G6 and K5. Firmness is good, averaging in excess of 300g/cm^2 but able to exceed 400g/cm^2 naturally. Shape is more cordate than kidney and stem medium to long stem with thin to medium thickness which behave quite robustly. Texture is firm and flavor good, being sweet low acid on G6 and K5 and low to moderate acidity on Mazzard. G6 trees were harvested 12th December 2017 despite having higher crop loads than the K5 and Mazzard trees which were harvested 17th December 2017. Both K5 and Mazzard trees with the lower MH crops also showed slight nose and ring cracking which needs to be monitored in future years. This line looks to be an excellent cropper on all rootstocks. Breeding program seedling results on two lightly cropped observations suggested a harvest time of 17th December with good size (11.3gm, 32mm) and some firmness. Previously rated a 3rd tier selection from the breeding program its improved cropping performance and firmness makes it quite promising. Figure 15 shows EB1.95 fruit harvested from a G6 tree on 12th December 2017. Figure 16 shows EB1.95 fruit on a K5 tree on 17th December 2017.

Figures 15 & 16