

Final Report

Selecting and releasing to industry high quality fresh and dried apricots for export and domestic markets

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Content

Content	3
Summary	4
Keywords	5
Introduction	6
Methodology	7
Outputs	9
Outcomes	10
Monitoring and evaluation	11
Recommendations	12
Refereed scientific publications	13
References	14
Intellectual property, commercialisation and confidentiality	15
Acknowledgements	16
Appendices	17

Summary

Seventeen new apricot varieties are being made available and promoted to both the Australian fresh market and dried apricot industries. These will provide better flavored apricots to consumers and a competitive advantage to growers.

In 2007 the South Australian Research & Development Institute (SARDI) National Apricot Breeding Program made crosses that produced 4500 new apricot seedlings. This project was conducted to finalize selections from this resource and complete their evaluation toward commercialization. Superior new apricot varieties arising from these evaluations are now being made available commercially to fresh and dried Australian apricot growers for use in export and domestic markets.

The SARDI apricot program is a 35 year old traditional apricot breeding program which in response to reduced resources in 2012 partnered with both Australian Dried Tree Fruit Inc (ADTF) & South Australian Fresh Fruit Growers Association (SAFFGA) to finalize the development of its final cohort of bred material. This partnership was critical in ensuring that the benefits of superior new varieties are now being realized and not lost to the Australian Industries.

The dried apricot industry needed to develop new improved apricots varieties to fundamentally improve the cost structures of production to sustain and grow the industry. These varieties needed to maintain a traditional full colour cut half style while improving overall reliability, quality and yield both on tree and post processing though improved dry ratios. New varieties also need to be robust enough to be compatible with new mechanized labour saving production systems.

The fresh market apricot industry in Australia is dependent largely on imported Californian varieties which while large, firm and attractive are largely flavor compromised (acidic or lacking), resulting in declining market share and widespread consumer dissatisfaction. A focus on increased fruit sugars in breeding and consumer eating experience via sensory panels during evaluation has clearly identified several lines that deliver greatly improved consumer eating quality and are well adapted to Australian conditions.

The best of the lines developed, many of which are capable of performing within both industries, will now be made available commercially. The new varieties will be supported by grower information sheets to enable growers to make informed decisions on their use and please consumers with a vastly improved consumer focused product on retail shelves.

Keywords

Apricots; fresh market apricots; dried apricots; new varieties; export markets; plant breeding; variety evaluation

Introduction

SARDI, a division of Primary Industries and Regions South Australia (PIRSA) has conducted a substantial apricot breeding program at Loxton in South Australia since the mid 1980's directed at supporting and improving the local dried apricot industry. This was done to improve the cost structures of production, quality and the reliability of product supply, combating competition from cheap imported (mainly Turkish) dried apricots through new and improved varieties while continuing to deliver a recognizable Australian style product.

Initial emphasis was placed on raising total fruit soluble solids (TSS) or fruit sugars measured as Brix. This is a major driver of improved dry ratio which simply means, more product for the same work. More recently significant emphasis has been placed on the evaluation of crosses from this program to realize their fresh market potential, driven by the realization that there was great improvement being shown in the flavor profiles of seedling populations. The use of fresh market genetics in breeding to improve the size, firmness and precocity above that normally shown by higher sugar drying parental lines and generally improved fruit sugars levels in progeny, added a critical flavor factor being neglected in the breeding of modern varieties. The focus on improved fruit sugars as a major component of flavor gives this breeding program a unique perspective and a tactical advantage over other breeding programs in the pursuit of an improved eating experience and ultimately greater sales in markets.

Current varieties servicing the domestic fresh market are primarily imported from major private Californian or European breeding programs in the early to mid-season maturities and more recently New Zealand for later season maturities. Many imported varieties currently utilized by the fresh market sector display improved aesthetic qualities, such as size, firmness, color and blush, compared to the older varieties they replaced. These varieties have been successful from a visual appeal, durability and handling view point but have largely ignored the consumer qualities of flavor and eating experience. Leading to a decline in market share for apricots compared to other fruit and snack products. In many cases imported cultivars do not suit Australian climatic conditions often being too high chill and crop poorly. Many also display an acidic flavor profile which when harvested early to survive the supply chain leads to a very poor consumer eating experience. Apricots are known to be a highly site specific species in their habits with locally bred material likely to have an advantage over imported in general reliability.

The apricot breeding program from 2002 to 2008 produced 3000-4000 seedling trees annually from crosses aimed at producing new varieties for both the drying and fresh markets. These seedling crosses were initially screened as they began cropping in high density field blocks for maturity timing, crop load, fruit size, fruit firmness and texture, flesh colour, total soluble solids (TSS), defects and flavor. Lines of suitable quality were selected and grafted onto rootstock for more rigorous evaluation under normal growing conditions. Breeding activities ceased following crosses made in 2007 and these were planted in high density seedling tree blocks in 2009. Following a reduction in available SARDI resources ADTFA and SAFFGA partnered in this project to finalize selection in 2012 of the remaining 4500 seedlings, guiding them through evaluation and the start of commercialization over the next five season. This ensured that the benefit of new varieties was identified and not lost to Australian fruit growers.

Methodology

As with all breeding and evaluation projects a comprehensive, systematic and well-structured approach was required to successfully unlock the remaining fresh market and dried potential that existed within the germplasm developed. The methodology used in this project is a combination existing techniques used in previous breeding projects (e.g. HAL Project DT01006 and DT04001) to ensure data collected built consistently on that previously collected and new techniques to support and extend this knowledge base. Also to provide clear evidence of the superior attributes of the new varieties to support promotion and commercialization to growers and achieve optimal uptake.

This project began the selection process of actively downsizing the high density breeding plantings from approximately 4500 seedlings to 105. Getting those seedlings selected as having potential grafted onto rootstocks (mainly Myrobalan H29C) for secondary evaluation. Most commonly, 6 grafted trees of promising lines were planted for secondary evaluation with the inclusion of strategic comparator varieties to allow for use in PBR DUS trials. This avoids the delay and expense of planting separate trials for PBR at a later date but means higher numbers of trees are carried initially.

For secondary evaluation assessment, trees were trained to a free standing-V formation at 2.5m intervals with 5m between rows to simulate a commercial orchard. Both fresh fruit and dried assessments were performed as described on fruit from seedlings trees until sufficiently mature grafted evaluation trees were available, at which time fruit from these trees was proffered. Trees were also produced on rootstock for regional grower field trialing. Trees were made available to cooperating growers each winter under non-propagation and testing agreements. This was a strategy to decrease lead times to full commercial release by having grower data and experiences to support that of the breeding program.

Each season all fruiting trees had an assessment of their fruits agronomic characters carried out at “tree ripe maturity”. The fruit of each tree was assessed preliminarily on trees at three day intervals during harvest and was potentially rejected in the field on the basis of size, softness and blemish. Lines that passed the preliminary screen had up to 10 fruit picked for laboratory assessment of a more complete range of characters including harvest date, size, weight, TSS, firmness, shape, colour and taste. Lines were then assigned an action category based on overall performance.

Lines assessed as having drying potential in the current or previous seasons were also harvested at “tree ripe plus 2 days” for dried fruit assessment. This involves processing and test drying a fruit sample into cut halves via commercial techniques, determining the dry ratio, assessing the quality parameters and storage life of the sample under standardized conditions. The quality rating system takes into account fruit colour, size, thickness and lustre visually to produce an overall rating. The industry standard cv. “Moorpark” was given an arbitrary rating of 3.5 in average condition on a 1 to 5 scale as a comparator. Storage length trials were conducted on dried lines after character assessments. This was done by placing 6-8 dried halves in a plastic mesh bag and storing on ventilated shelves at 25°C and 65% relative humidity. Fruit was assessed monthly and discarded once it reached a darkness level visually equivalent to OD 0.3. In assessing the darkness of dried apricots, an optical absorbance reading of 0.3 was considered the limit of acceptability by Nury and Brekke (1963). This value was also supported as a practical guide by McBean and Wallace (1967).

Lines with superior fresh market appeal require more extensive evaluation. Lines were identified from past results for inclusion in fresh post-harvest handling storage trials and samples picked at an earlier maturity to the “tree ripe” agronomic samples, usually by 3 to 5 days. This is consistent with normal commercial growing and packing operations. These samples were split into 3 sub-samples, photographed and one sub-sample assessed for visual appearance (blush, background colour, lustre, marking-of the stem cavity & cheeks), bruising, firmness (quantitative by penetrometer, 7mm tip) durability of skin, juiciness, eating texture, flavor, TSS and defects, culminating in an overall rating for quality and storage ability. This is performed at the earliest opportunity with the least time in storage, preferably the same day (0 days). The further two sub-samples are stored for 10 days at 2C and 10 days at 2C plus 24hrs at 20C respectively to simulate storage and retail shelf life, they are then also assessed in the same manner to compare changes.

Major changes that may become apparent through this process are colour changes, marking and bruising becoming evident, reductions in acidity and shifts in flavor profile and occasionally the production of off-flavors, fruit softening and reduction in fruit juiciness. This provides information about consistency of production and knowledge of potential handling issues

Critically as we approach commercialization of these new varieties it was felt that a fourth major assessment type

was required, a quantitative end use measure with a consumer focus. So a series of consumer sensory eating experience panels were run on both fresh and dried fruit samples.

Consumer sensory panels were only run with people who identified as liking apricots. The industry standard apricots such as Earlicot, Poppicot, Katy, Robada, Magicot and Moorpark were used as a biological comparators in appropriate timeslots, also often a single line from the panel before was used again as the comparator to provide perspective between panels. Apricot samples were specifically picked for this task at an appropriate maturity and any blemished fruit graded out, samples were stored at 2C and conditioned by leaving the box open at room temperature the night prior to the panel testing. Only 6 lines were presented in each panel so as not to overload participants. Fruit was then presented in a coded randomized fashion to participants as a cut, de-stoned half, the other half of which was pressure tested and measured for total soluble solids (Brix). For each fruit half in the randomized panel participants were asked to rate Overall eating experience (OEE), Flavour and Sweetness on 150mm line scale of dislike to like and Toughness of skin, Firmness of flesh and Sourness on a 150mm line scale of too soft or not sour enough to too tough, too hard or too sour respectively, where 75mm was marked as “just right”. Age group and gender were also recorded for participants as was their overall favorite sample.

Panels were also run along similar lines with washed and rehydrated dried fruit lines from the 2015/16 and 2016/17 harvests. The results of these were far less definitive with respect to the different characters measured, eating experience and appearance have proved most useful with sweetness and sourness less so. They do however serve to help cull outliers for particular characters. Parallels can also be drawn between fresh and dried characters which is helpful in determining limits in fresh fruit that impact dried quality.

Grower evaluation was also an important and final oversight to the process with growers planting semi-commercial plantings (50-100 trees) of several lines under Non-Propagation & Testing Agreement as they became confident with the evidence presented that the new varieties may suit their operations. This will enable significant volumes of fruit to enter grower packing line evaluation and trial marketing arrangements. Owing to the timelines involved with tree production and growth this process has been set up and started but fruit production and the supply of information back to the evaluation process has not yet occurred.

This entire integrated process and the information produced should provide the transparency and confidence at both grower and retail level to maximize variety adoption and facilitate growth in fresh apricot markets based on flavor and consumer satisfaction.

Outputs

New fresh market apricot varieties with improved consumer attributes were evaluated and are being made available to Australian growers, providing them with a consumer focused product enabling market development and an opportunity to grower per capita consumption. See “New Variety Grower Information Sheets” in the Appendix.

Eight new fresh apricot varieties of superior eating quality with acceptable post-harvest handling characteristics from this project are being promoted to Australian growers through accredited nurseries under a Non-propagation Agreement. However, as many as 14 are potentially being made available to growers via the wider release program.

New dried apricot varieties that will fill production gaps, improve overall dried product quality and increase reliability of production were developed in this project. These will improve industry cost structures, increase grower returns and assist Australian growers to compete against cheaper, inferior products potentially allowing the development of an export industry. See “New Variety Grower Information Sheets” in the Appendix.

Fifteen new drying apricot varieties with superior performance characteristics are being made available to Australian dried fruit growers through accredited nurseries under a Non-propagation Agreement.

Comprehensive “New Variety Grower Information Sheets” have been produced to better inform growers and to promote and support the commercialization of the new varieties. See “New Variety Grower Information Sheets” in the Appendix.

Outcomes

New apricot varieties that have the eating qualities expected by consumers have been produced, evaluated and made available to growers.

Growers themselves now have access to comprehensive information about these new varieties under Australian conditions. This provides an improvement in grower knowledge and confidence to take up these new varieties as this type of information is rarely provided prior to the release of international varieties. Overall it should reduce the risk assumed by growers in adopting new apricot varieties. Apricots are considered a difficult and often site specific crop to produce.

A report commissioned by SARDI and undertaken by SGA Solutions in 2010 suggested that new better tasting apricot cultivars could generate a demand for approximately 171,000 new trees to 2023, producing an incremental volume of 15,885t per year in 2026, more than doubling current volumes. The report also found that these increases would drive an increase in incremental value of \$13 million by 2026. These better tasting apricots would expand both domestic and export markets.

Industry sources indicate that improved varieties could drive a 50% increase in the apricot production of the dried tree fruit industry within the next 10 years. Benefits resulting would include improving the sustainability of the industry and providing enterprise diversity as well as social and economic benefits to Riverland communities.

The economics of dried apricot production, although not being the primary focus of this project appears greatly improved by the new varieties, however this remains to be fully tested in larger scale plantings. Apricots are by their nature relatively water use efficient at around 6-7ML/Ha compared to wine grapes (6-7ML/ha) and Almonds (14ML/ha), and nutrition for quality is best carefully regulated. All new varieties seem capable of producing consistent crops above 25t/ha with improved quality and dry ratios around 5:1 or lower. This information suggests gross grower returns above \$50,000/ha are achievable and should make the crop attractive to regional producers.

Improved production of better quality products in both the fresh and dried industry sectors also raises the specter of opening new export markets and expanding existing ones.

Industry adoption is likely to be relatively rapid as the level of awareness and direct involvement of the two industry organizations and their members is high. At the time of writing of this report commercialization talks were well advanced between IP holders and industry to ensure an appropriate commercialization pathway acceptable to industry is utilized. Uptake of new varieties is dependent upon demonstrating clear benefits of improved varieties with enhanced consumer satisfaction attributes to producers and marketers.

Monitoring and evaluation

This research agreement was originally contracted 13/02/13 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 Midterm Review conducted 2/2/16 by Hort Innovation 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 process.

Midterm Review (HI-2/2/16)

Purpose: “In response to the Statutory Funding Agreement (SFA) between the Australian Government and Horticulture Innovation Australia Limited (Hort Innovation), we are required to show transparency and competitive process in the procurement of all projects especially when funding is managed by a third party such as an Industry Representative Body (IRB). This midterm project review , meeting (via teleconference) and questionnaire allowed for growers and service providers to provide Hort Innovation with feedback on *MT12015 -Selecting and releasing to industry high quality fresh and dried Australian apricots for export and domestic markets* to ensure that it is meeting their expectations and the priorities for this research area”.

Outcome: “The midterm review has informed Hort Innovation that the project is meeting the expectation of growers within the fresh and dried apricot industries and those of Hort Innovation. This provides confidence that the project should proceed as contracted with the opportunity for additional focus on key areas.

The project was not a competitive or transparent procurement, but based on the first year of the contract addressing the final year of breeding while bringing the fresh and dried industries together, the large amount of background intellectual property and need to coordinate two separate industries required the ability engage all parties successfully. Hort Innovation believes this is being coordinated and delivered effectively, which may not have been possible without the key participants who are currently involved (Dried Fruits Australia, Australian Dried Tree Fruits, SARDI and SAFFGA). The PMC also provides an additional level of governance with a number of key growers participating and directing the project.” The final recommendation of this process stated: “The project is considered as very important to industry and should proceed to completion.”

Project Management Committee (PMC)

The project management committee met in formal meetings, 5/4/13; 1/8/13; 23/10/13; 28/2/14; 9/5/14 (with A. Kumar, HI); 3/3/15; 24/2/16; 13/2/17, 12/4/18

The PMC accepted the reports and presentations from both SARDI and industry evaluator detailing the evaluation process and criteria being used and endorsed any culling or advancement recommendations that had been made on the basis of evidence provided at the meetings.

Media

An article about the project and asking for Expressions of interest in grower trialing was run in the industry magazine The Vine, Volume 10, Issue 4, Oct-Dec 2014. Another was run in The Vine, July-Oct 2015 again updating growers and advertising trial trees as available. Further articles were run in The Vine in Jan-Mar 2017 and Oct-Dec 2017, updating growers on the breeding program and focusing on the results of the consumer eating experience panel work. More recently, articles about the project finishing were run in Apr-Jun 2018 and again in July-Sep 2018 editions of The Vine.

A fruit show was run for growers with fresh and dried product on show at the Loxton Research Centre (17/12/15) and two radio interviews were given the same day. Dried tree fruits conferences were held 6/12/16 and 6/12/17 with field walks to view fruit on trees. Radio interviews about the breeding program were also given on ABC radio 13/2/17 and 5/12/17.

It is also planned to attend the 2018 Riverland Field Days 21 & 22 September 2018 and show dried fruit samples, the New Variety Grower Information Sheets and talk to interested growers.

Recommendations

It is recommended that:

- The new varieties described in the “New Variety Grower Information Sheets” (see Appendix) be commercialized and made available to Australian apricot growers together with this information.
- New Variety Grower Information Sheets continue to be updated with grower evaluation experiences as they become available over the next few years.
- That SARDI be asked to store the remaining germplasm, maintain and supply budwood for the new varieties to commercial nurseries to ensure the control of IP and integrity of the new varieties.
- Production trials should be developed to collect information with regard to costs and returns in commercial enterprises utilizing these new varieties to clearly demonstrate the economic advantages of the new varieties to other growers.

Refereed scientific publications

Nil

References

McBean, D. and Wallace, J.J. (1967). "Stability of moist-pack apricots in storage". CSIRO Food Preservation Quarterly. 27:29-35.

Nury, F.S. and Brekke, J.E (1963). "Colour studies on processed dried fruit". Journal of Food Science. 28:95-98.

Intellectual property, commercialisation and confidentiality

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

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Dried Fruit Growers: K.Werner, T.Loffler, J.Quirke

Technical: D.Graetz

Appendices

Data Collection and Interpretation

At the beginning of this project approximately 4,500 seedling apricot crosses were available to be selected from. Based on SARDI general agronomic assessment data from 2012/13 (2013) this number was reduced to 105 seedlings. This also included a group of 22 seedlings retained on the advice of a respected Fresh Fruit industry grower evaluator based on “on-tree” observations that harvest season. Following this all remaining seedling trees were grafted onto myrobalan plum rootstock to produce a minimum of 6 grafted evaluation trees.

Over subsequent seasons a range of evaluations were performed

- General Agronomic Performance (all cropping trees each season)
- Dried Evaluation (test dry and evaluate quality and storage on lines of interest for drying)
- Fresh Post Harvest Quality and Handling evaluation (on specifically harvested lines identified of interest to the fresh market)

Each season all results for individual apricot lines were reviewed by the breeder to determine a course of further action for that particular apricot line. This decision was then communicated to the PMC and ratification sought at the following PMC meeting. Lines identified for removal had both seedling and grafted trees physically removed from blocks.

Table 1 below summarizes the different yearly evaluations performed categorizing results and decisions on line removals.

Table 1: Evaluations by year with categorized results and line removal numbers

Year	General Agronomic Assessments					Drying Assessments				Fresh Post-Harvest Assessments				Lines for Removal
	Lines	Total	Good	Ok	Reject	Total	Good	Ok	Poor	Total	Good	Ok	Poor	
13/14	105	95	29	39	27	18	4	13	1	29	9	10	10	37
14/15	65	64	29	26	8	51	13	33	5	46	16	14	16	28
15/16	37	37	23	11	3	30	10	16	4	30	13	11	6	14
16/17	24	24	9	11	4	19	10(1)	6	3	20	9(2)	3	6	8
17/18	16	16	13	3	0	15	8(2)	6	1	15	9(2)	4	2	1

Table 1 summarizes and simplifies an enormous body of data. Fruit crops are a notoriously variable subject with quantity and quality dictated by a range of seasonal factors. As far as possible decisions were dictated by the body of data collected for each line to reduce subjectivity in decisions.

The simplification of just the General Agronomic Assessment data masks the quantity of work and effort that has gone into its collection. During 2017/18 (2018) the entire evaluation program performed 393 evaluations of which 105 pertained to the 16 lines remaining to be dealt with by this projects. This is to gauge variability in results based on the expression of agronomic characters of individual trees, both seedling and grafted, in differing situations. The average of these many assessment results are presented in Table 1.

Table 2 expands the detail that has gone into the Table 1 summary.

Table 2: Summary of individual General Agronomic Assessments for the 2017/18 season

Line	General Agronomic Assessments				Final Position
	Total	Good	Ok	Reject	
36443	6	6	0	0	Good
36480	5	0	5	0	Ok
36539	7	7	0	0	Good
36544	4	3	1	0	Good
36605	7	5	2	0	Good
36878	2	0	2	0	Ok
37105	5	4	1	0	Good
37356	7	5	2	0	Good
37388	5	4	1	0	Good
37422	3	1	2	0	Ok
37551	8	8	0	0	Good
37612	6	5	1	0	Good
37752	15	15	0	0	Good
37890	8	6	2	0	Good
37908	6	4	1	1	Good
37986	11	11	0	0	Good

Often many individual assessments make up an overall result for a particular assessment type in a given season. All information needs to be considered to determine if tree to tree variability may be an issue. In the case of general agronomic characters this seems to be quite stable with only a few lines requiring further investigation. Often excessive variability alone is reason to reject and remove a line as its preferred performance remains stable.

Additional complexity arises in the need to also consider temporal variability between different seasons. This is best demonstrated in Fresh Post-Harvest Quality & Handling results over several seasons as different seasonal growing conditions are expressed in the quality of the fresh fruit harvested and assessed. Table 3 details the 2017/18 Fresh Post-Harvest Quality & Handling results and those of previous seasons. It can be seen far more quality variation occurs in apricot lines between seasons than between trees within a season.

Table 3: Fresh Post-Harvest Quality & Handling Assessment Results

Line	2017/18		Observations 2012-2018				
	Total	Result	Total	Very Good	Good	Ok	Poor
36443	1	Good	4	2	2	0	0
36480	1	Ok	6	0	1	4	1
36539	1	Ok	4	0	2	2	0
36544	1	Good	4	0	2	2	0
36605	1	Ok	4	1	1	2	0
37105	1	Good	5	2	1	2	0
37356	1	Poor	5	1	0	3	1
37388	1	Very Good	8	4	1	3	0
37422	1	Poor	4	1	1	0	2
37551	1	Good	3	2	1	0	0
37612	1	Good	4	3	1	0	0
37752	2	Ok	7	1	1	3	2
37890	1	Very Good	5	4	1	0	0
37908	1	Good	4	0	2	2	0
37986	1	Good	7	2	3	1	1

All these assessments combined paint an increasingly confident picture as to the quality of the apricots lines performance and how it may benefit the grower, packer and marketer. The missing element as is often the case is a quantitative end use measure with a consumer focus. A series of consumer sensory eating experience panels were run on both fresh and dried fruit samples in an attempt to benchmark how individual lines performed in the most subjective of measures, flavor and eating experience.

Consumer sensory panels were conducted with people who identified as liking apricots. The industry standard apricots such as Earlicot, Poppicot, Katy, Robada, Magicot and Moorpark were used as a biological comparators in appropriate timeslots, also often a single line from the panel before was used as the comparator to provide perspective on consistency between panels. Apricot samples were specifically picked for this task at an appropriate maturity and any blemished fruit graded out. Samples were stored at 2C and conditioned by leaving the box open at room temperature the night prior to the panel testing. Only 6 lines were presented in each panel so as not to overload participants. Fruit was then presented in a coded randomized fashion to participants as a cut, de-stoned half, the other half of which was pressure tested and measured for total soluble solids (Brix). For each fruit half in the randomized panel participants were asked to rate Overall Eating Experience (OEE), Flavour and Sweetness on 150mm line scale of dislike to like and Toughness of skin, Firmness of flesh and Sourness on a 150mm line scale of too soft or not sour enough to too tough, too hard or too sour respectively, with 75mm marked as just right. Age group and gender were also recorded for participants as was their overall favorite sample.

The results obtained across 3 years (2016-2018) of consumer sensory panels are extremely valuable, summarized below in Table 4. Very broadly 5 lines from this project were compared in one panel in 2016, 14 lines in 5 panels in 2017 and 17 lines in 7 panels in 2018. These lines were compared with a range of common fresh market apricots in appropriate production time slots. Earlicot is a common early fresh market apricot well accepted by the market, a large and firm but somewhat shy lateral bearer it has low fruit sugars, will soften quickly and drop as it matures on the tree, OEE scores only ranged between 46 to 64 in 4 separate panels. Poppicot is a very early, large, well coloured but pastel apricot, it has low brix and often meets market resistance due to its acidic flavor profile, it scored an OEE of 63 in the one panel we used it, this was also a relatively mature fruit sample. It was also noted as being one of the sourest apricots we tested, results show it should not be grown for fresh market if a good consumer experience is sought. Robada and the more recent release Magicot were both tested in 2018, both apricots are large, firm and very flashily blushed with deep coloured juicy flesh, making them very attractive, however both have relatively low brix levels at harvest 14.1 and 13.2 respectively and a sweet acid flavor profile without much other complexity. Both scored 72 for OEE and struggled against the sweeter, more complex and better flavoured lines under development here. Generalizing from OEE results to date 70-80 could be considered borderline, 80-90 Ok, 90-100 good, 100-110 very good and over 110 exceptional in terms of eating experience.

There is variety analyses that can be performed with these results, however for the purposes of this project it is sufficient to compare means and note any outliers for specific quality traits. Surprisingly despite the year to year variation that can occur in fruit quality results are relatively reproducible and consistent giving confidence in their use. Overall Eating Experience (OEE) results closely mirror the results for Flavour and differences within and across years can be largely attributed to crop load and brix level which are themselves negatively related and can also affect timing of fruit maturity. Skin toughness and firmness of flesh also seem to be somewhat linked and poorly distinguished by panel participants with deviations mainly appearing where the skin has different physical characteristics to it such as grittiness or the fruit is very soft or with structure but prone to bruising. It would have been nice to have had the resources to examine further changes in OEE of the same fruit lines with increasing maturity from the tree at harvest but unfortunately this wasn't the case. The few lines we were able to get data for show a general improvement in OEE and flavor with increased maturity as would be expected, largely due to increased sweetness, higher TSS levels and a lowering of sourness to allow the expression of more complex fruit flavors.

The use of different forms of assessment tailored to answer questions about critical points in the supply chain is extremely useful. Lines 36502 and 32341 reported in 2016 and 2017 season are not typical apricot lines, they are small to medium, extremely firm and crunchy with high fruit sugars (total soluble solids), making them appear very sweet. Line 36502 has some contrasting acidity, and is a real sensory experience. Line 32341 is low acid and more a textural oddity being extremely firm and very crunchy in texture, almost non-melting. Both are susceptible to a higher degree of weather damage and marking than normal apricot types and were rated down accordingly in Post-Harvest Handling. These lines were being investigated as a niche or specialty products. However the balance of results lead to 36502 being discarded as too difficult to produce due to weather and handling marking. Line 32341 proved in sensory panels to be too different to what consumers expect an apricot to be, its low acid nature while inoffensive was characterized as bland, this allowed it also to be removed from commercialization although it has been retained for genetic purposes.

Table 4: Summary of Fresh Apricot Eating Experience Sensory Panel results 2016-2018

Line	Year	Harvest Date	Test Date	Stored days	Test #	Crop Load	OEE /150	Skin >75<	Firm >75<	Flav /150	Sweet /150	Sour >75<	TSS	Firm	% Fav
36443	2016	17/11/15	14/12/15	27	1	H	78	71	55	74	75	73	15.3	1.0	3
36443	2017	7/12/16	8/12/16	1	2	VH	100	82	71	96	96	82	17.6	2.1	30
36443	2018	27/11/17	5/12/17	8	2	H	104	73	67	98	98	70	16.8	1.4	30
36480	2017	28/11/16	1/12/16	3	1	VH	90	73	65	90	91	72	14.5	3.1	5
36480	2018	24/11/17	29/11/17	5	1	VH	91	81	78	88	89	74	15.1	2.2	15
36539	2017	19/12/16	10/1/17	22	5	MH	68	101	106	71	67	83	22.4	3.9	10
36539	2018	14/12/17	18/12/17	4	5	H	75	96	103	77	67	94	23.3	4.3	0
36544	2018	19/12/17	21/12/17	2	6	H	105	88	85	108	105	81	23.5	3.5	35
36605	2017	20/12/16	10/1/17	21	5	H	84	76	63	77	81	72	17.0	1.7	10
36605	2018	19/12/17	21/12/17	2	6	VH	93	80	73	86	89	76	16.6	1.7	15
37105	2017	28/11/16	1/12/16	3	1	M	94	88	94	86	80	81	15.7	3.0	10
37105	2018	27/11/17	29/11/17	2	1	MH	94	81	84	81	83	74	15.4	2.4	10
37105	2018	27/11/17	5/12/17	8	2	MH	86	82	72	76	83	75	15.2	1.9	10
37356	2017	7/12/16	8/12/16	1	2	H	86	95	88	79	89	88	19.5	3.4	15
37388	2016	4/12/15	14/12/15	10	1	VH	118	88	73	119	120	77	18.2	2.3	57
37388	2017	13/12/16	14/12/16	1	3	L	97	92	93	87	83	84	19.6	3.5	15
37388	2017	19/12/16	21/12/16	2	4	MH	116	84	84	112	102	85	20.9	2.6	40
37388	2018	7/12/17	12/12/17	5	3	VH	91	97	88	98	91	85	19.6	3.6	30
37388	2018	11/12/17	13/12/17	2	4	H	99	90	77	95	93	83	20.4	2.8	15
37422	2018	24/12/17	8/1/18	15	7	MH	92	81	71	88	82	69	17	2.2	10
37551	2016	27/11/15	14/12/15	17	1	VH	92	87	84	92	91	80	17.8	3.7	20
37551	2017	7/12/16	8/12/16	1	2	LM	104	82	76	100	99	82	20.1	2.4	20
37551	2018	7/12/17	12/12/17	5	3	H	97	89	82	90	92	80	17.3	2.8	5
37551	2018	14/12/17	18/12/17	4	5	VH	94	77	68	86	83	74	18.0	1.6	5
37612	2017	20/12/16	21/12/16	1	4	VH	101	87	78	101	100	75	20.6	3.3	5
37612	2017	20/12/16	10/1/17	21	5	VH	93	78	66	85	92	66	19.8	1.9	25
37612	2018	14/12/17	18/12/17	4	5	LM	105	86	72	113	112	71	24.0	2.5	45
37752	2018	14/12/17	18/12/17	4	5	H	102	75	67	106	104	71	21.6	1.8	10
37890	2016	23/11/15	14/12/15	21	1	H	88	80	72	81	84	75	17.0	1.7	13
37890	2017	7/12/16	8/12/16	1	2	MH	88	89	86	90	95	87	20.2	3.2	20
37890	2017	7/12/16	14/12/16	7	3	MH	97	80	69	96	95	81	19.7	2.4	35
37890	2018	27/11/17	29/11/17	2	1	H	117	79	75	111	112	80	19.1	1.9	55
37908	2018	11/12/17	13/12/17	2	4	LM	110	87	75	112	110	71	21.3	2.1	20
37986	2017	7/12/16	14/12/16	7	3	MH	96	80	68	95	90	70	17.1	2.4	20
37986	2018	1/12/17	5/12/17	4	2	H	86	87	82	77	77	63	15.7	2.2	15
Earlicot	2016	13/11/15	14/12/15	31	1	H	46	87	83	38	50	98	12.2	2.2	0
Earlicot	2017	28/11/16	1/12/16	1	1	LM	64	95	92	64	63	94	13.5	3.3	0
Earlicot	2017	28/11/16	8/12/16	9	2	LM	52	90	88	47	50	97	13.2	3.2	0
Earlicot	2018	20/11/17	29/11/17	9	1	MH	56	84	78	61	57	76	11.3	2.6	0
Katy	2018	4/12/17	12/12/17	8	3	VH	48	63	41	43	41	64	10.6	1.5	0
Magicot	2018	22/11/17	29/11/17	7	1	MH	72	82	70	75	72	74	13.2	2.2	0
MPK	2018	2/1/18	8/1/18	6	7	M	79	62	52	74	72	65	14	1.1	0
Popicot	2017	25/11/16	1/12/16	6	1	LM	63	82	79	57	51	98	12.3	2.0	5
Robada	2018	11/12/17	13/12/17	2	4	VH	72	79	77	73	67	88	14.1	2.3	5

Legend: Test #= panel number for that year; Crop Load (L=light; LM=light moderate; M=moderate; MH=moderately heavy; H=heavy; VH=very heavy); OEE /150= Overall Eating Experience, dislike to like, 0 to 150; Skin >75<=Toughness of skin, too soft(0) to too tough(150) around Just right(75); Firm >75<=Firmness of flesh, too soft(0) to too Hard(150) around Just right(75); Flav /150= Flavour, dislike to like, 0 to 150; Sweet /150= Sweetness, dislike to like, 0 to 150; Sour >75<=Sourness, not sour enough(0) to too sour(150) around Just right(75); TSS= average TSS (Brix) of all fruit tested in panel; Firm= average Firmness (gm/cm²) of all fruit for a particular line tested in that panel; % Fav= percentage of participants that chose the line as their overall favorite in the panel.

The performances of 36433, 37551, 37388 and 37612 are all excellent as fresh market apricots. Some of the high TSS drying lines such as 37908 have outstanding flavor and eating experience but are cosmetically challenged which downgrades their prospects for the fresh market. Such a line while outstandingly flavored is only rated as a 3rd tier prospect for fresh market use (see Table 8). The performance of 37015 in the very early timeslot compared to similar looking lines already available to industry is also very encouraging, helped mainly by a lack of acidity even when immature. Results also indicated that 37388 is very dependent on achieving a greater maturity for improved eating attributes and that line 37890 may benefit from longer in cold storage or pre-conditioning presumably to lower acid levels associated with the skin before being preferred by consumers. Even line 36539 which scored a poor 68 in 2017 may have an interesting nuance hidden in the data as it was rated highly and as most favored by two participants Asian descent. In 2018 it again performed similarly scoring 75 and was rated highly by the low number of Asian participants involved in the panel without being the most preferred. Unfortunately numbers of Asian participants were too low to draw definitive conclusions. Overall the data reflects significant consumer quality advances these new lines potentially offer in the market place.

It should also be pointed out that this a data pertains only to the apricot breeding material that is the subject of this project, other germplasm outside this scope from earlier breeding also performed well. Notably lines 17614 (119, 96), 22358(102, 106), 25166 (119, 100, 102, 100) and 35213 (104, 96), and which in terms of consumer eating quality appear to be elite performers. Table 9 reflects the relative numbers of project lines and broader breeding program lines still under consideration.

Profitability will always be a tradeoff between managing cropping levels and maturity for optimal flavor and optimizing production and managing risk both in the field through weather and other forms of crop damage and packing, handling wastage through to market. Ultimately it will always come down to the dedication of growers and marketers to manage these concerns to provide consumers with the best possible eating experience. It is clear that these new apricot varieties provide a significant advantage in fulfilling this objective.

Finally as a check on the outcomes of the dried fruit breeding we bulk dried a range of dried fruit lines of promise and varying character to try and objectively compared the taste with that of the main current commercial varieties and other promising lines from the wider breeding program. Table 5, presents these results. This was done to ensure flavor and eating experience profiles were in line with common market acceptance. In the off-season of 2017, 6 panels were run in similar style to the fresh apricot panels with washed and rehydrated (21% moisture) dried fruit lines from 2016 and 2017 harvests. The results of these were less definitive with respect to the different characters measured, overall eating experience and appearance have proved most useful with sweetness and sourness less so. In general overall eating experience followed flavor less closely than with fresh product, consumers taking far more notice of visual and textural cues. As a sulphured product, dried fruit is substantially transformed from the fresh state which seems to add some degree of consumer confusion as to what individuals like and dislike. These results do however serve to help cull outliers for particular characters. Parallels can also be drawn between fresh and dried characters which is helpful in determining limits in fresh fruit that impact dried quality. Encouragingly most lines appear as good as or better than the industry standard Moorpark in overall eating experience, overall appearance, color and texture. Lines such as 29110, 31072 and 36443 do seem to have higher acidity profiles in the dried product but still score well for flavor and overall eating experience presumably due to higher fruit sugars to balance the acidity, although consumers don't seem to pick this up as clearly in the taste. To date dried lines had been selected on their production advantages, dried fruit visual quality and storage ability. This positive consumer indexing and unbiased view of flavor and appearance adds extra confidence that great improvement has been made in drying apricots for Australian growers without loss of consumer quality.

Table 6 and 7 present a condensed view of the top rated apricots lines for drying and fresh market respectively, that will be available to Australian grows as a result of this project and the wider breeding program activities. Project lines have been highlighted in yellow to indicate where they are placed in the context of the wider resource. Also included is an average view of the major characteristics of each line, this will be further expanded in the grower information sheets that follow for individual lines.

Table 5: Summary of Dried Apricot Eating Experience Sensory Panel results 2016-2018

Line	Year	Panel #	Date Tested	OEE /150	OA /150	Colour /150	Texture >75<	Flavour /150	Sweet /150	Sour >75<
10520	2016	4	25/8/17	91	102	105	76	89	91	74
11353	2016	1	4/8/17	101	106	106	74	85	82	72
15742	2016	6	9/10/17	89	105	89	92	88	85	75
19880	2016	2	11/8/17	79	103	97	79	68	79	58
22926	2017	5	31/8/17	93	94	100	93	81	84	66
24086	2016	6	9/10/17	93	117	115	68	87	87	60
24691	2016	2	11/8/17	93	113	109	67	80	88	57
24992	2017	5	31/8/17	102	103	108	66	100	101	72
25166	2016	1	4/8/17	97	114	117	71	86	89	63
26385	2016	4	25/8/17	112	120	121	74	107	106	73
29110	2017	5	31/8/17	112	107	107	92	93	96	92
30754	2017	6	9/10/17	100	97	91	86	96	98	78
31054	2017	5	31/8/17	109	115	115	76	103	106	83
31072	2017	5	31/8/17	104	115	117	72	102	92	94
31072	2017	6	9/10/17	92	103	108	77	91	85	94
34769	2016	3	15/8/17	108	115	116	82	98	96	66
35213	2016	4	25/8/17	86	106	104	90	86	86	72
35226	2016	4	25/8/17	103	116	118	83	91	97	68
36443	2016	1	4/8/17	87	97	100	85	89	80	89
36443	2016	2	11/8/17	86	117	111	89	84	81	87
36539	2016	3	15/8/17	112	113	112	82	114	110	71
36539	2017	6	9/10/17	89	92	88	98	91	84	84
36605	2017	5	31/8/17	105	114	105	76	99	90	88
37551	2016	1	4/8/17	108	107	116	73	104	95	80
37551	2016	3	15/8/17	103	108	108	86	93	82	92
37612	2016	2	11/8/17	95	112	107	69	86	91	62
37752	2016	2	11/8/17	115	121	118	72	109	103	77
37890	2016	1	4/8/17	106	107	106	72	103	97	74
37890	2016	4	25/8/17	102	106	112	79	102	89	87
37908	2016	6	9/10/17	111	120	120	68	102	98	72
37986	2016	3	15/8/17	105	107	111	86	99	103	76
Hunter	2016	3	15/8/17	95	107	114	70	87	91	68
Moorpark	2016	1	4/8/17	93	103	121	64	78	91	64
Moorpark	2016	2	11/8/17	86	107	110	56	82	91	61
Moorpark	2017	3	15/8/17	100	89	96	66	84	89	72
Moorpark	2017	4	25/8/17	79	86	79	71	73	81	68

Legend: Line=breeding line or variety identity; Year= harvest year dried sample was produced; Panel #=panel number; Date tested+ date panel was run; OEE /150= Overall Eating Experience, dislike to like, 0 to 150; OA /150= Overall Appearance, dislike to like, 0 to 150; Colour /150= Colour of dried fruit sample, dislike to like, 0 to 150; Texture >75<=Texture of sample, too soft(0) to too tough(150) around Just right(75); Texture /150= Texture of dried fruit sample, dislike to like, 0 to 150; Firm >75<=Firmness of flesh, too soft(0) to too Hard(150) around Just right(75); Flavour /150= Flavour, dislike to like, 0 to 150; Sweet /150= Sweetness, dislike to like, 0 to 150; Sour >75<=Sourness, not sour enough(0) to too sour(150) around Just right(75).

Table 6. Highest rated apricot lines for drying (project lines in yellow)

Line	Maturity	Crop	Firm	Size gm	Size mm	TSS	Dry Quality	Dry Ratio	Fresh Rating	Self fertile	Bloom
36480	19 Nov	H	F	56	49 (50)	16	Ok	5.4	2	+	3 Sept
36443	24 Nov	MH	F	62	52 (55)	20	V.Good	5.5	1	+	9 Sept
37890	28 Nov	H	F	54	48 (57)	21	V.Good	4.5	1	+	3 Sept
35213	30 Nov	H	VF	63	50 (57)	20	Ex	4.9	1	-?	3 Sept
34769	1 Dec	H	VF	69	52 (57)	17	Good	4.9	1	+	8 Sept
37551	4 Dec	MH	VF	63	50 (58)	20	Ex	4.7	1	+	2 Sept
37752	4 Dec	MH	F	55	49 (57)	19	Ex	4.7	2	+	6 Sept
37908	5 Dec	MH	VF	61	51 (57)	21	Ex	4.3	3	+	5 Sept
24992	6 Dec	H	F	57	49 (54)	23	V.Good	4.4	No	+	5 Sept
22926	10 Dec	MH	MF	74	51 (58)	20	Ex	4.8	No	+	30 Aug
35226	10 Dec	H	VF	81	54 (57)	20	Ex	5.3	1	+	5 Sept
River Early	12 Dec	MH	MF	66	50 (57)	19	Ex	5.0	No	+	5 Sept
37612	12 Dec	MH	F	51	47 (50)	22	Ex	3.9	1	+	19 Sept
36605	15 Dec	H	VF	61	49 (54)	19	Good	5.0	1	+	13 Sept
31054	21 Dec	H	MF	59	50 (53)	23	Good	5.0	No	+	7 Sept
31324	21 Dec	H	F	52	49 (54)	22	OK	5.1	No	+	7 Sept
22358	22 Dec	MH	VF	66	50 (57)	18	Ex	4.6	1	+	20 Sept
24691	24 Dec	M	VF	54	47 (58)	20	V.Good	4.8	1	+	16 Sept
24680	26 Dec	MH	VF	45	46 (52)	19	Ex	4.2	1	+	11 Sept
Moorpark	29 Dec	MH	MF	53	48	16	Ok	5.9	No	+	19 Sept

Legend: Line= line number (project lines in yellow); Maturity=average ripening date at Loxton Research Centre; Crop=average crop load(M=moderate, MH=moderately heavy, H=heavy); Firm=average firmness(MF=moderately firm, F=firm, VF=very firm); Size gm=average fruit size in grams; Size mm=average fruit size in millimeters across the cheek; TSS=average TSS in brix; Dried Quality=average dried quality rating; Dry ratio=average dry ratio; Fresh Rating=average rating for fresh market use(1=first tier very good, 2= second tier ok, 3=third tier ok but only in specific circumstances, No= not recommended); Self-fertile= self-fertility status(+self-fertile, -?=probably not self-fertile); Bloom=average bloom date at Loxton Research Centre.

Table 8 details only the remaining lines that are the subject of the project and displays their industry ratings to date. Lines 37105 (fresh), 37356 (not recommended for fresh or dried) and 37612 (multi use) are actively being investigated for use by the canning/processing industry and have several seasons of positive results in this area. I suspect 37356 will eventually be discounted for the same reasons it has been discounted in this project, its propensity to rain damage and mark, as the Australian canning industry is one of few worldwide that do not chemically peel fruit when processed. Line number 36878 is a genetic rarity producing glabrous or non-pubescent fruit with a smooth nectarine like skin. It's very late maturity and self- fertility are also seen as positives while its small fruit size is a negative issue. Of Chinese descent this line will be added to the valuable genetic resources discovered and collected by the breeding program throughout its various iterations. Line 36539 is also elite for its firmness and very high brix levels. Its texture presents as a crunchy shell with some acidity around a super sweet juicy melting center, some issues with increased risk of rain damage and odd flavor profile damage its fresh market and to a lesser extent its dried prospects. Its dried appearance is of lighter colour with a very thick fleshy body which is easily chewed even when overall moisture levels in the dried product are low. Reminding evaluators of being jube like in character it would make an interesting value added product covered in chocolate, having extra compactness and body over the normal dried apricot. All lines remaining will be added to the genetic collection.

Table 7. Highest rated apricot lines for fresh market (project lines in yellow)

Line	Maturity	Crop	Firm	Size gm	Size mm	TSS	Dry Quality	Dry Ratio	Dry Rating	Self Fertile	Bloom
Earlicot	18 Nov	LM	F	79	53 (62)	14					20 Aug
37105	25 Nov	MH	F	63	48 (57)	18	V.Good	5.2	3	-?	7 Sept
36443	24 Nov	MH	F	62	52 (55)	20	V.Good	5.5	1	+	9 Sept
37890	28 Nov	H	F	54	48 (57)	21	V.Good	4.5	1	+	3 Sept
35213	30 Nov	H	VF	63	50 (57)	20	Ex	4.9	1	-?	3 Sept
34769	1 Dec	H	VF	69	52 (57)	17	Good	4.9	1	+	8 Sept
37986	2 Dec	M	VF	61	49 (52)	19	Good	5.3	2	-?	10 Sept
37551	4 Dec	MH	VF	63	50 (58)	20	Ex	4.7	1	+	2 Sept
24086	8 Dec	MH	VF	58	49 (53)	19	Ex	4.6	3	-	9 Sept
25166	8 Dec	MH	VF	62	51 (55)	22	Ex	4.4	2	+	31 Aug
35226	10 Dec	H	VF	81	54 (57)	20	Ex	5.3	1	+	5 Sept
37388	10 Dec	MH	VF	49	46 (52)	23	Ex?	4.2	2	-?	12 Sept
37612	12 Dec	MH	F	51	47 (50)	22	Ex	3.9	1	+	19 Sept
36544	13 Dec	M	VF	68	50 (53)	23	V.Good	4.0	2	-?	13 Sept
36605	15 Dec	H	VF	61	49 (54)	19	Good	5.0	1	+	13 Sept
22358	22 Dec	MH	VF	66	50 (57)	18	Ex	4.6	1	+	20 Sept
24691	24 Dec	M	VF	54	47 (58)	20	V.Good	4.8	1	+	16 Sept
24680	26 Dec	MH	VF	45	46 (52)	19	Ex	4.2	1	+	11 Sept

Legend: Line= line number (project lines in yellow); Maturity=average ripening date at Loxton Research Centre; Crop=average crop load(M=moderate, MH=moderately heavy, H=heavy); Firm=average firmness(MF=moderately firm, F=firm, VF=very firm); Size gm=average fruit size in grams; Size mm=average fruit size in millimeters across the cheek; TSS=average TSS in brix; Dried Quality=average dried quality rating; Dry ratio=average dry ratio; Dry Rating=average rating for drying use(1=first tier very good, 2= second tier ok, 3=third tier ok but only in specific circumstances, No= not recommended); Self-fertile= self-fertility status(+self-fertile, -?=probably not self-fertile); Bloom=average bloom date at Loxton Research Centre.

Table 8: Status of remaining project lines

Line	Fresh Rating	Dry Rating	Comment
36443	1	1	
36480	2	1	
36539	No	2	Elite for firmness and TSS
36544	1	2	Elite for firmness and TSS
36605	1	1	
36878	No	No	Genetics only, very late and glabrous
37105	1	3	Investigated for canning
37356	No	No	Investigated for canning
37388	1	2	
37422	No	No	
37551	1	1	Elite genetics
37612	1	1	Investigated for canning
37752	2	1	
37890	1	1	Elite genetics
37908	3	1	
37986	1	2	

Legend: Line= line number; Fresh Rating=average rating for fresh market use (1=first tier very good, 2= second tier ok, 3=third tier ok but only in specific circumstances, No= not recommended); Dry Rating=average rating for drying use(1=first tier very good, 2= second tier ok, 3=third tier ok but only in specific circumstances, No= not recommended); Comments= comments about other uses for the line.

Table 9. Comparison of project lines with total breeding program resource

Drying Apricot Lines			
Rating	Total	Project	Other
1	19	8	11
2	14	4	10
3	4	1	3
Fresh Market Apricot Lines			
Rating	Total	Project	Other
1	17	9	8
2	7	2	5
3	3	1	2

Legend: Rating=rating for type of use (1=first tier very good, 2= second tier ok, 3=third tier ok but only in specific circumstances), Total= total number of lines in the entire breeding program for that use, Project= number of lines pertaining to this project for that use; Other= number of breeding program lines outside the project for that use.

Finally Table 9 compares the ratings of the entire remaining breeding program with the remaining project lines. Value still resides in lower rated lines for niche areas of production. Apricots being a noted site specific crop some of these lower rated lines may well come to the fore in specific locations or provide backup for other more highly rated lines should unforeseen issues arise. Table 9 also highlights how much more rapid genetic advancement became in the breeding of these final crosses. The final 4500 seedling crosses producing roughly equal numbers of promising new varieties as the previous 33000 seedling crosses. Of course it was the parents discovered within this vast pool of earlier crosses and breeding experience gained with them that enabled the last crossings to be both targeted and productive.

Commercialization

Following discussions with the PMC it was decided to preference the varieties shown below in Table 10. A total of 17 new apricot varieties of which 9 (37890, 37551, 37612, 36605, 37105, 37388, 36443, 37752 and 37908 were the subject of this project.

The naming convention agreed to preferences and references the fresh market use of the lines as this is the industry in which a name is likely to receive the most focus in terms of communication with consumers. Names involving places were discounted to avoid parochialism and a descriptive element preferred. Previous naming conventions had followed the “Flavor” and “River” prefix for fresh and dried use lines, followed by a descriptive term that referenced the lines qualities. We have decided to maintain part of this by referring to groups of lines as a series based on flavor profile or use qualities. The post script taking the form of a maturity reference, 1 for the earliest time of harvest then sequentially 2 3 4 etc with harvest time becoming later. The complexly flavored lines (fruitiness and floral flavors) recommended for the fresh market will be known as FlavorCot 1, 2, 3, 4 & 5. The conventionally flavored lines recommended for the fresh market (based on sugar and acid profiles of less complexity) displaying enhanced sweetness will be known as Tasticot 1, 2 &3. All other lines recommended for drying uses will continue to follow the existing “River” convention, RiverCot 1, 2, 3, 4, 5, 6, 7, 8 & 9. Coincidentally all fresh market lines can be used for drying by virtue of their higher fruit sugar levels but not all drying lines can be used for fresh market purposes due to handling, visual or textural issues. Some recommended drying varieties are however quite suitable for fresh market purposes although they have not been preference for that use by us. It will be up to growers to decide if they wish to trial them in their own enterprises for this use now that they are being made available. All remaining top tier (1) rated lines for a specific purpose will be re-rated to tier 2 and current tier 2 lines demoted to tier 3. These will be retained in the genetics collection and made available to interested growers in small batched of trees should interest be shown.

New varieties to be promoted

Fresh (8 Lines)

37980 (FlavorCot 1)

37551 (FlavorCot 2)

25166 (FlavorCot 3)

37612 (FlavorCot 4)

36605 (FlavorCot 5)

37105 (TastiCot 1)

35213 (TastiCot 2)

37388 (TastiCot 3)

Dried (9 Lines)

36443 (RiverCot 1)

34769 (RiverCot 2)

37752 (RiverCot 3)

37908 (RiverCot 4)

24992 (RiverCot 5)

22926 (RiverCot 6)

35226 (RiverCot 7)

31054 (RiverCot 8)

24680 (RiverCot 9)

No system will be perfect but this is an attempt to simplify and make the release of 17 varieties as logical as possible, given the large amount of duality in the use of most lines. Some very good fresh market lines get a commercial opportunity promoted for drying. Alternatively the dried industry gets access to 15 good dried lines some promoted to growers as fresh market opportunities.

Interestingly all the non self-fertile lines all fell into the TastiCot group despite being of differing genetic backgrounds.

Table 10: Lines to be promoted for commercialization (project lines highlighted) with comparators

Name	Line #	Fresh rating	Dried rating	Maturity	Crop	Firm	Size mm	TSS	Dry Quality	Dry Ratio	Self-fertility	Av. Bloom
Earlicot			No	18 Nov	LM	F	53 (62)	14	No	N/A	-	20 Aug
RiverCot 1	36443	1	1	24 Nov	MH	F	52 (55)	20	V.Good	5.5	+	9 Sept
TastiCot 1	37105	1	3	25 Nov	MH	F	48 (57)	18	V.Good	5.2	-?	7 Sept
FlavorCot 1	37890	1	1	28 Nov	H	F	48 (57)	21	V.Good	4.5	+	3 Sept
TastiCot 2	35213	1	1	30 Nov	H	VF	50 (57)	20	Ex	4.9	-?	3 Sept
RiverCot 2	34769	1	1	1 Dec	H	VF	52 (57)	17	Good	4.9	+	8 Sept
FlavorCot 2	37551	1	1	4 Dec	MH	VF	50 (58)	20	Ex	4.7	+	2 Sept
RiverCot 3	37752	2	1	4 Dec	MH	F	49 (57)	19	Ex	4.7	+	6 Sept
RiverCot 4	37908	3	1	5 Dec	MH	VF	51 (57)	21	Ex	4.3	+	5 Sept
RiverCot 5	24992	No	1	6 Dec	H	F	49 (54)	23	V.Good	4.4	+	5 Sept
FlavorCot 3	25166	1	2	8 Dec	MH	VF	51 (55)	22	Ex	4.4	+	31 Aug
RiverCot 6	22926	No	1	10 Dec	MH	MF	51 (58)	20	Ex	4.8	+	30 Aug
RiverCot 7	35226	1	1	10 Dec	H	VF	54 (57)	20	Ex	5.3	+	5 Sept
TastiCot 3	37388	1	2	10 Dec	MH	VF	46 (52)	23	Ex	4.2	-?	12 Sept
River Early	11353	No	1	12 Dec	MH	MF	50 (57)	19	Ex	5	+	5 Sept
FlavorCot 4	37612	1	1	12 Dec	MH	F	47 (50)	22	Ex	3.9	+	19 Sept
Story C6				14 Dec	M	S	46 (47)	17	Ok	5.3	+	18 Aug
FlavorCot 5	36605	1	1	15 Dec	H	VF	49 (54)	19	Good	5	+	13 Sept
RiverCot 8	31054	No	1	21 Dec	H	MF	50 (53)	23	Good	5	+	7 Sept
River Ruby	10520	2	2	22 Dec	M	F	49 (55)	19	Ex	5	+	17 Sept
RiverCot 9	24680	1	1	26 Dec	MH	VF	46 (52)	19	Ex	4.2	+	11 Sept
Moorpark C1				29 Dec	MH	MF	48 (50)	16	Ok	5.9	+	19 Sept

Legend: Varieties Earlicot, River Early, Story C5 and Moorpark C1 are included as comparators. Name= proposed series name; Line # = Breeding program line number, synonym; Fresh rating= fresh market use rating (1=first tier very good, 2= second tier ok, 3=third tier ok but only in specific circumstances, No= not recommended); Dried rating=average rating for drying use (1=first tier very good, 2= second tier ok, 3=third tier ok but only in specific circumstances, No= not recommended); Maturity=average ripening date at Loxton Research Centre; Crop=average crop load (M=moderate, MH=moderately heavy, H=heavy); Firm=average firmness(MF=moderately firm, F=firm, VF=very firm; Size mm=average fruit size in millimeters across the cheek; TSS=average TSS in brix; Dried Quality=average dried quality rating; Dry ratio=average dry ratio;; Self-fertile= self-fertility status(+self-fertile, -?=probably not self-fertile); Bloom=average full bloom date at Loxton Research Centre.