

Australian Strawberry Breeding Program Update

Temperate end of season report, and subtropical and Mediterranean trial update
BS17000: National Strawberry Varietal Improvement Program (2017-2022)

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The Australian Strawberry Breeding Program (ASBP) is a national breeding program, with a focus on Australia's three major production climates: temperate, subtropical, and Mediterranean. The program's aim is to breed new strawberry varieties that are specially adapted to each region, and to release superior selections to industry that meet consumer preferences and are highly profitable for growers with lower production costs.

The ASBP has now completed the 2019/20 summer trial for the temperate production region, and planting of new subtropical and Mediterranean trials has recently been completed. As such, now is a good time for an update on these regions and how we are achieving our goal of developing new varieties.

Each of our trials is comprised of four stages: seedling trials, early-stage clonal trials, advanced-stage clonal trials, and on-farm trials. Every year we perform controlled cross-pollinations to create thousands of genetically unique seedlings. These seedlings are then assessed in field trials in their production region for one season.

The most promising seedlings (those with desirable fruit and plant architecture characteristics) are then clonally propagated via runners and planted into randomised and replicated 'early-stage' clonal trials.

Plants in the early-stage trials are evaluated every week for a large number of traits, and the best performing plants are selected at the end of the season for further evaluation in 'advanced-stage' trials. Detailed assessments are again conducted weekly on the advanced clones, and the best plants are again selected and distributed to fruit growers for their feedback on varieties when grown in an 'on-farm' environment.

This grower input is very valuable and helps to identify selections for future commercialisation as new varieties. These four stages of trials run simultaneously each year for each production region. Following is a summary of recent progress in each region.



Figure 1. Fruit of new temperate ASBP varieties: (A) 'Scarlet-silk'; (B) 'Summer Song'

Photo Credit: Jodi Neal

Temperate breeding trials

Evaluation of material in the temperate breeding trial was conducted from October 2019 to February 2020 in Wandin, Victoria. The trial at Applethorpe, Queensland unfortunately had to be concluded prematurely due to drought and is unable to be run in 2020 for the same reason.

The main trial at Wandin, comprising 95% of the total temperate seedlings, is still going ahead as per usual in 2020.

Over 12,000 seedlings were assessed at Wandin this season, with 112 of these selected to progress to early stage trials this year. There were also 66 early- and 29 advanced-stage selections included in the trial, of which 19 and eight were selected for further evaluation, respectively.

Eleven advanced temperate selections were trialled on farms across Victoria, Tasmania, South Australia, Queensland and Western Australia.

Subtropical breeding trials

The ASBP subtropical trials are conducted at Maroochy Research Facility (Nambour) and Bundaberg Research Facility, Queensland. The subtropical 2020 trials were planted in early- to mid-March and include 6,300 seedlings at Nambour and 5,000 at Bundaberg (Figure 2).

We will also be evaluating 63 early-stage and 33 advanced-stage selections.

Six selections will be assessed in on-farm trials on growers' properties across south-east Queensland, prior to commercialisation decisions being made.

Mediterranean breeding trials

The Australian Mediterranean strawberry production region is centred around Perth, WA, however due to travel restrictions imposed by COVID-19 this trial will be conducted at Nambour in 2020.

A total of 2,350 Mediterranean seedlings will be assessed, which is a large increase in numbers compared to last year's trial (Figure 3).

There will also be nine early- and three advanced-stage Mediterranean selections trialled.



Figure 2. 2020 subtropical breeding trials in Queensland: (A) seedling trial at Maroochy Research Facility, Nambour; (B) seedling trial at Bundaberg Research Facility. Photo Credit: Dale McKenna (2A) Justin Davies (2B)

Disease resistance trials

Routine disease resistance experiments continue throughout the year for advanced selections from all production regions. These experiments inform which varieties are best for release to industry and also help to guide cross-pollinations for production of seedlings to increase disease resistance levels in our breeding population. Current experiments are screening 23 selections for resistance to *Fusarium oxysporum* f. sp. *fragariae*, and 18 selections for *Macrophomina phaseolina* (charcoal rot). Over the autumn season, we aim to screen a further 28 selections for resistance to *Fusarium*, 22 for resistance to *Colletotrichum gloeosporioides*, and 21 selections for resistance to charcoal rot. We also have a powdery mildew resistance screening trial at Nambour in 2020, which is conducted on substrate (hydroponics), and is comprised of 212 seedlings, and 30 commercial- and advanced-stage clones from all three major production regions (Figure 4).

New tissue culture laboratory

At our headquarters at Maroochy Research Facility we have a brand-new tissue culture laboratory for the ASBP. Plant tissue culture is the method of growing and multiplying plants in gel media in a sterile environment. This allows us to maintain a collection of our varieties and allows us to propagate clean material, in addition to using runner-based propagation. Our new laboratory means that we can increase the size of our collection, and we are trialling a new media which may be better for plant transition from the lab to the glasshouse.

A new plant breeder joins the team!

Finally, we are pleased to welcome Dr Katie O'Connor to the team as a plant breeder to assist Dr Jodi Neal. Katie has recently completed her PhD research in DNA-informed breeding in macadamia trees. Our breeding program currently employs DNA analyses to help select elite varieties with certain flavour profiles. With Katie's knowledge, we will be expanding our genomic work in other traits to more efficiently identify the best candidate varieties in a shorter time frame.



Dr Katie O'Connor. Photo Credit: DAF

One of the guiding principles of the breeding work is to foster the exchange of ideas, so please contact Dr Jodi Neal (jodi.neal@daf.qld.gov.au or 07 5381 1352) if you would like more information. We value your thoughts and appreciate your feedback for the project team.



Figure 3. Planting the Mediterranean seedling trial.

Photo Credit: Dale McKenna

Figure 4. 2020 powdery mildew resistance screening experiment.

Photo Credit: Dale McKenna

THE AUSTRALIAN STRAWBERRY BREEDING PROGRAM TEAM MEMBERS



L-R: The Australian Strawberry Breeding Program Team Members include: Dr Jodi Neal (Project Lead), Clinton Buck (Nambour Field Assistant), Janine Conway (Laboratory Technical Officer), Apollo Gomez (Pathology), Sue Hibbit (Wandin Field Assistant), Lien Ko (Virus Indexing & Pathology), Dale McKenna (Nambour Field Technical Officer & Hydroponics), Allan Mcwaters (Applethorpe Technical Officer), Alan Noon (Wandin Field Assistant), Dr Katie O'Connor (Breeding and Genomics), Michelle Paynter (Virus Indexing, Tissue Culture & Pathology), Karen Spencer (Wandin Operations Manager), Matthew Webb (Genomics) & Louella Woolcock (Nambour Field & Glasshouse Operations Manager).

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We thank the contributions by the Temperate and Subtropical Reference Groups and Mediterranean industry members who have helped guide the program, the Industry Development Officers, and all other industry members who provide feedback, advice, and support.

We are also extremely grateful to all the fruit producers in all states who have trialled, collected data on, and given feedback on our on-farm selections. This has helped us make more informed and better commercial judgments.

