



**Horticulture
Innovation**
Australia



National Passionfruit Breeding Program – Field Day, Alstonville/Wollongbar

Peter Bundock

24 July 2019



National Passionfruit Breeding Program



- Now three years into the (originally) three-year HIA levy-funded project (started July 2016)
- October last year HIA advised that no additional R & D levy funds available for breeding program in 2019 – 2020 financial year



One year no cost extension to Breeding Program

- Decided on option to extend program for extra year at no cost (i.e. make savings and spread funds across extra year)
- Project variation to add extra year signed off early July 2019
- Variation has incorporated changes to the project suggested from the review in January



What has been achieved?

- Initially work focused solely on breeding new scion varieties – purples that requires grafting – replacements for Sweetheart & Misty Gem
- Crossing – initially carried out mainly by David Peasley
- Rearing seedlings – McLeods, SCU, Griffiths
- Grafting of seedlings (if required)
- Carrying out trialling



Trialing of vines for selection of new scion



- Staged trialing process
 - 1) Stage 1 – seedlings from crosses
 - 2) Stage 2 – selections from stage 1, tips grafted and trialed in several locations in duplicate
 - 3) Stage 3 – best selections from stage 2, increased number of grafted vines representing each selection



Trialing for scion variety



- 2016 crosses

Stage 1		
# crosses	# lines	# sites
6	782	4

Sweetheart x Pandora
 Pandora x No. 12
 Tom x No. 12
 Tom x Lacey

Burringbar
 Yandina
 Murwillumbah (2 sites)



Trialing for scion variety



- 2016 crosses

Stage 1	2016-2017	
# crosses	# lines	# sites
6	782	4

Stage 2 (2017 -2018)			
# lines (# families)	# grafted vines	#sites	#reps
29 (5)	111	3 (+6)	3 (or 9)

Sweetheart x Pandora
 Pandora x No. 12
 Tom x No. 12
 Tom x Lacey

Burringbar
 Duranbah
 Clothiers Ck. (1)



Trialing for scion variety



- 2016 crosses

Stage 1 (2016-2017)		
# crosses	# lines	# sites
6	782	4

Stage 2 (2017 -2018)			
# lines (# fam.)	# vines	#sites	#reps
29 (5)	111	3 (+6)	3 (or 9)

Stage 3 (2018 – 2020)			
# lines (# fam.)	# vines	# locations	#reps
12 (3)	466 (+283)	9	7 - 85

Sweetheart x Pandora
 Pandora x No. 12
 Tom x No. 12

Clothiers Ck – (1)
 Clothiers Ck – (2)
 Bundaberg
 Yandina
 Round Mtn
 Murwillumbah



Trialing for scion variety



- 2017 crosses

year of Stage 1	# crosses	# families	# lines	# sites
2017	3	4 (originally 10)	~500	2

Tom x Tom
Tom x Lacey

Burringbar
Newrybar



Trialing for scion variety



- 2018 crosses

year of Stage 1	# crosses	# families	# lines	# sites
2018	10	9	~452	5

Tom x PAI No. 10
Black Gem x No. 10
Tom x Lacey
Misty x Misty
Lilikoi O.P.

Imbil, Qld
Burringbar, NSW
Tolga (Nth Qld.)
Alstonville DPI



3rd stage trial – 2018/19



Parents – 1st Trial Year – Vine No.	No. grafted vines planned for trial
Sweetheart x Pandora - 2016 - 59	65
Sweetheart x Pandora - 2016 – 36D	65
Pandora x No.12 - 2016 - 37	20
Pandora x No.12 - 2016 - 33	65
Sweetheart x Pandora - 2016 - 90	20
Sweetheart x Pandora - 2016 – 42D	29
Toms Sp. X No.12 - 2016 - 4	65
Pandora x No.12 - 2016 - 53	41
Sweetheart x Pandora - 2016 – 72	20
Sweetheart x Pandora - 2016 – 22D	20
Sweetheart x Pandora - 2016 – 4D	20
Sweetheart x Pandora - 2016 - 55	20
Total	450



2016/17 1st stage trials



- 3rd stage trial (2018/19) proposed for 12 of these selections

SP-16-59
Good performer



Trialing for scion variety



Main outcome:

- ~12 selections (elite material from 2016) that form the basis of the crossing program along with current commercial varieties – Misty Gem and Sweetheart. Eight of these have been used in crosses that are at seedling stage to go into Stage 1 trials this year
- Possible – one of these 12 selections might be useful in its own right (current Stage 3 - growing in replicate at 6 locations)



Trialing for scion variety



What has been learned:

- 1) No more trials with Tom x Lacey seedlings!
- 2) Many crosses require grafting of seedlings to beat *Fusarium oxysporum*!
- 3) Direct crosses with Pandora – usually fruit too large, leaf die back during winter, fruit colour not typical purple (brown with spots)



Rootstock trial – this season

Location	Scion variety	No. different rootstocks	No. vines total	Observations	Result to date
Bundaberg	Misty Gem	10	698	~16,000 fruit counted on vine, for 190 vines	One line (F1 – Pandora x QDPI) clearly lower yielding. Too early to score <i>Fusarium solani</i> infection effects (yr 2 vines)
Round Mountain, NSW	Tango	7	99	Delayed until new fruit forming	
Round Mountain	Sweetheart	7	98	Delayed until new fruit forming	
Clothiers Ck. (2)	Tango	7	97	Some counting in May	Not conclusive
Clothiers Ck (1)	Flamenco	7	96	>5,000 fruit counted in duplicate, for 86 vines	One line (Lakelands) clearly lower yielding

Panama trial – this season

Location	No. different Panama lines	No. vines total	Observations	Result to date
Bundaberg	5	456	Score sheet completed	Lakelands line performs poorly at this site.

2019 – controlled pollination program



- 1) To produce seed for 1st stage trial seedlings (200+ vines, 2019 season)
- 2) To self hybrids from rootstock and panama program to produce seed for further inbreeding – new selections in the future
- 3) To continue inbreeding of 1st and 2nd generation inbreds (Lacey x Lacey, Tom x Tom)
- 4) To maintain inbred lines for the breeding program into the future (Pandoras, McGuffies, Qld DPI flav.)



2019 – controlled pollination program



- 370 controlled pollinations – self pollinations and crosses
- Selfed progeny from Toms Special – 3/4 self incompatible (most Australian cultivars are self compatible)
- 50% success rate for crosses – 50% cross pollinations
-> fruit



2019 – controlled pollination program



- Use clear microwave pie bag to bag buds the day before opening – to keep pollen thieves out!
- Can observe bud opening inside bag



Pollen thieves



2019 – controlled pollination program



- Bag used to cover flower after pollination – fruit development (or failure) can be observed through bag
- Bag is stable when wet!



2019 – controlled pollinations for 1st stage trial seedlings



- 50% success rate for crosses – 50% cross pollinations -> fruit
- 36 successful cross pollinations where a fruit was obtained
- 32 in time for sowing on 28/06/19
- 24 different crosses
- Selfed progeny from Toms Special – 3/4 self incompatible (most Australian cultivars are self compatible)
- Could not self-pollinate Lilikoi lines at Alstonville – also strongly self-incompatible



2019 – controlled pollinations for 1st stage trial seedlings



- Lilikoi – self incompatible – but strong healthy vines – with large yellow fruit
- Seed obtained from Florida
- Could be useful as rootstock, Panama breeding



2019 – 1st stage trial seedlings



Acc. No.	Cross	No. Germinants
PB19-410	Misty Gem x SP-16-59	4
PB19-381/382	Misty Gem x T12-16-4	5
PB19-380	P12-16-37 x Sweet Heart	36
PB19-353/354	SP-16-36D x Misty Gem	56
PB19-364	SP-16-42D x T12-16-4	53
PB19-384	SP-16-4D x Misty Gem	18
PB19-358/359	SP-16-72 x Misty Gem	35
PB19-361	SP-16-90 x Misty Gem	24
PB19-383	SP-16-90 x T12-16-4	53
PB19-401	Sweet Heart x SP-16-36D	23
PB19-356	T12-16-4 x SP-16-36D	58
PB19-347	Tom Special x P12-16-37	51
		416

Selections from 2016 represented
SP-16-59
T12-16-4
P12-16-37
SP-16-36D
SP-16-42D
SP-16-4D
SP-16-72
SP-16-90



2019 – 1st stage trial seedlings

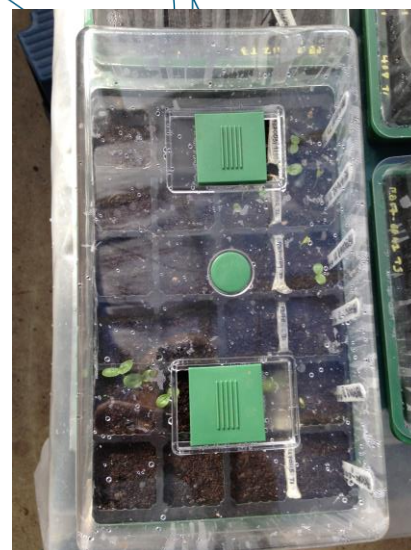


Seed from QDAFF seed bank

Acc. No.	Cross	No. Germinants
PB170042	96C x Tom Special	4
PB170069	Lacey x T5	2
PB170104	New Zealand P. edulis	0
PB170112	Pandora x Bills	8
PB170031	Possum purple. P.e x P.e x P.e. f. flav.	7
PB170115	Sweetheart x Bill	0
		21



2019 – 1st stage trial seedlings



Producing Inbred Lines for crossing



Inbreeding from Lacey

- Still going – selfing for 3rd generation this spring or summer

Inbreeding from Tom's Special

- Problematic due to most 1st generation inbreds being self-incompatible

Inbreeding from Sweetheart

- Seedlings do not survive without grafting – one years work lost here



National Passionfruit Breeding Program



Original Program Aims:

- To select potential new scion varieties
- Begin process of generating new inbred lines
- Establish seedbank
- Maintain industry arboretum



2018/19 1st stage trials



Parents	Total seedlings	Grafted seedlings
Toms Sp. x PAI #10	180	80
Black Gem x PAI #10	87	87
Misty x Misty	89	89
USA 'Purple'	18	18
USA Frederick (red/purple)	41	41
USA Lilikoi (flavicarpa)	40	20
Lacey x Lacey inbred lines	37	37
Misty Gem crosses	9	9
Total	501	381



Rootstock & Panama sub-project



True-breeding Lines	Crosses
McGuffies Red	McGuffies Red x Bunnings Pandora
Heuston	McGuffies Red x Griffiths Pandora
Q.DPI flavicarpa	McGuffies Red x McLeods Pandora
Griffiths Pandora	McLeods Pandora x Bunnings Pandora
McLeods Pandora	McLeods Pandora x QDPI flav.
Bunnings Pandora	McLeods Pandora x McGuffies Red
Cook Is. Pandora	Griffiths Pandora x McLeods Pandora
	Q.DPI flav. x McLeods Pandora
	QDPI flav. x McGuffies Red
	Bunnings Pandora x McGuffies Red
	Bunnings Pandora x QDPI flav.



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