

May 2016

REPORT: Visit on invitation to IRTA, Spain



Wiehann Steyn & Karen Theron
HORTGRO Science & Stellenbosch Univ.
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1. Introduction

- Prof Karen Theron attended the 2016 Eufirin Workgroup on Fruit Thinning in Porto, Portugal. Upon enquiring about the IRTA breeding programme and nursery industry in Spain, Dr Joan Bonany, Director of Pip & Stone fruits subprogram at IRTA, invited Karen to visit Spain. Considering the current discussions regarding breeding and evaluation of deciduous fruit in South Africa, the invitation to visit Spain was extended to Wiehann Steyn.
- The visit was paid for in full from discretionary funds of Karen and Wiehann at the University of Stellenbosch.

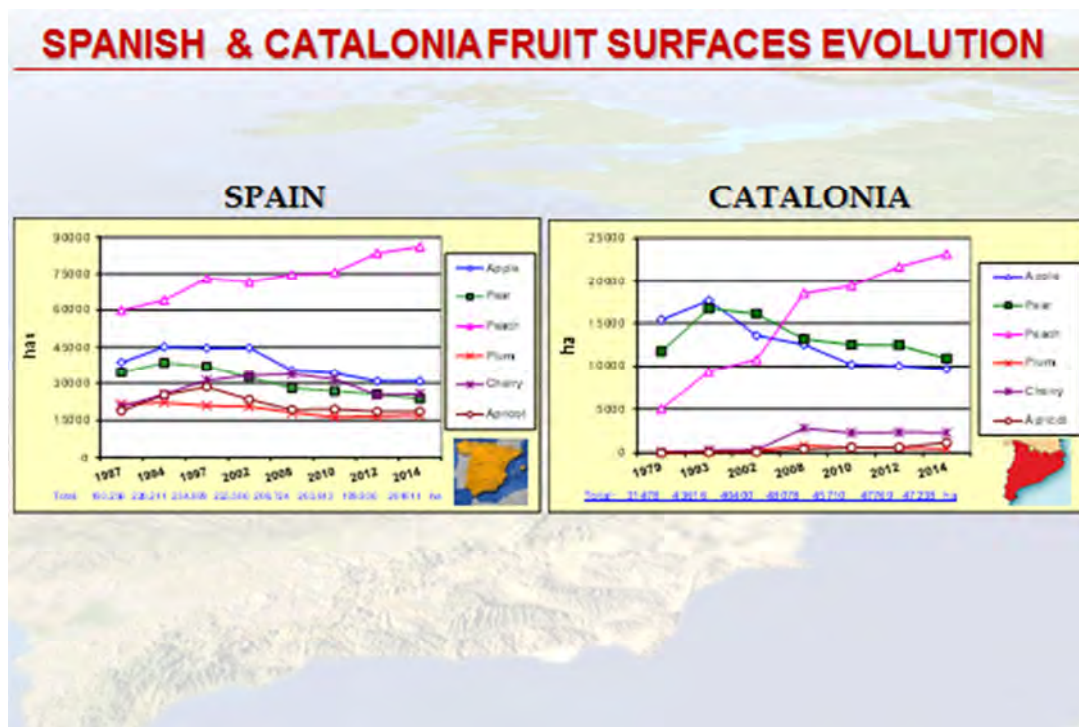
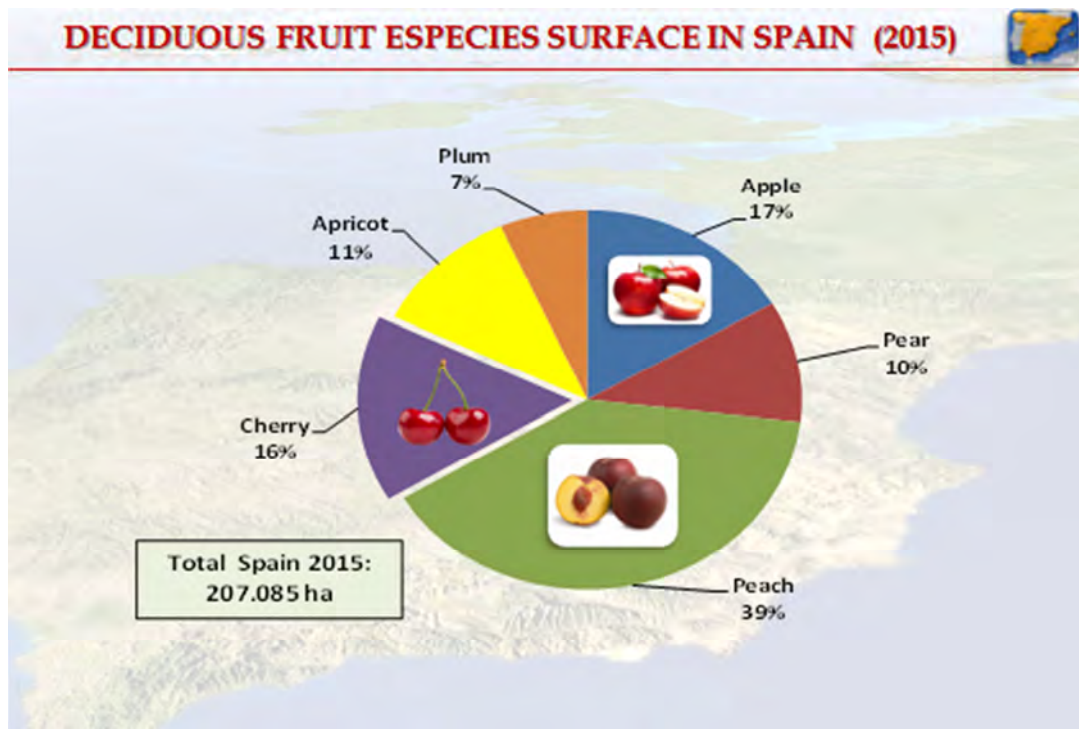


2. Objective of the visit:

The objectives of the visit were the following:

- Assess the IRTA breeding programme for climatically adapted pome and stone fruit for “best practices” benchmarking purposes to facilitate discussion on the industry-funded, ARC breeding programmes;
- Visit the long-running IRTA cultivar evaluation programme and discuss the benefits and downsides of various evaluation structures - with reference to Provar;
- Visit Agromillora tissue culture nursery and various fruit tree nurseries to assess trends in the European nursery industry. Poor plant material quality has been identified as one of the main limiting factors in the SA deciduous fruit industry and improving plant material quality is a major focus of the HORTGRO Science Crop Production programme.

3. Fruit production in Spain



- Production of apples decreasing – uncompetitive compared to South Tyrol and France.
- Sufficient chill (800-1000 h <7°C in Girona, much more in Lleida), but summers too warm for good colour development and required shape. A trend to move to higher areas in the foothills of the Pyrenees, although only a few hundred hectares of area are available here.
- Nets required due to frequent hail and sunburn.

- Granny Smith nets are black – not enough sunburn protection under white nets.
- Almost all apples on M9, but interest in Cornell Geneva range increasing due to replant.
- Pear industry is stagnant.
- Peach increasing – low profitability due to oversupply.
- Almonds very sharp increase in plantings.



Ultra-high density pear orchard near Lleida. Note the flat orchard floor to facilitate mechanisation (mechanical pruning etc.) and spray efficiency (high speed and low volume).

4. IRTA - Breeding and Evaluation programmes

Institution	IRTA , a research institute owned by the Government of Catalonia. IRTA operates under private and not public law.
Purpose	Contribute to the modernization, competitiveness and sustainable development of agriculture, food and aquaculture sectors, the supply of healthy and quality foods for consumers and, generally, improving the welfare of the population.
Hosts	Joan Bonany, Director of Pip & Stone Fruits Subprogram (Joan.Bonany@irta.cat) Dr Simó Alegre, Fruitcentre Director (simo.alegre@irta.cat) Dr Celia Cantin, Pome fruit breeder (celia.cantin@irta.cat) Dr Ignasi Batlle, Stone fruit breeding (ignasi.batlle@irta.cat) Dr Luis Asin, Rootstock breeding & Horticulture (luis.asin@irta.cat) Ignasi Iglesias, Scion & rootstock evaluation (ignasi.iglesias@irta.cat)
Structure & Capacity	• 514 staff, 177 researchers, 337 support staff • 9 centres • 983 staff if associated institutes included • 269 scientific articles in 2013, 317 papers at congresses, 115 technical articles & 21 PhD's. • 30 researchers in Fruit Post Harvest and Production • 5-7 researchers in Crop Protection • 4 researchers in Genetics & Biotech. • 6 researchers in Irrigation/water use efficiency
Funding	• 38.1 million Euro • 68.6% own funds, 31.4% government • Own funds generated through research funding calls, e.g. EU funding, and IP, contract research for companies • Industry – voluntary contribution, no levy and no research budget • 585 contracts of 10 million Euro
International collaboration	• Joint research unit with Plant & Food Research (PFR), NZ. Since legally recognised by EU, P&F staff can work on EU projects and staff can be exchanged.
Breeding programme	• Started in 2002 on apple and pear and 2004 on peach. The aim was to have the best plant material available as production then becomes easier, therefore huge effort should go in selection of the right plant material through breeding and strict evaluation • Main focus climatic adaptation (hot summers), eating quality, storability (low risk of disorders), disease resistance, high pH tolerant <i>Pyrus</i> rootstocks (also dwarfing, easy propagation and yield efficiency) • Breeding apples, pears (red blush that does not lose colour under high temperatures), peach/ nectarine (incl. donut nectarine) • Partners: PFR (Pome), ASF (Stone) and INRA (pear rootstock) • PPP: FRUIT FUTUR AIE- an Economic Interest consisting of four Catalanian fruit production firms (ACTEL, NUFRI, POMA from GIRONA, and FRUITS DE PONENT) and IRTA Lleida Fruitcentre • Matched government funding • 50% of IP belongs to technology partner (ASF or PFR) and rest split equally

	between FRUIT FUTUR members - Currently inviting partners for international commercialization – Stargrow enquires regularly. - Industry co-invested in release
Cultivar evaluation	- Peach, cherry, apricot, pear, apple, rootstocks - Since 1996, 1156 scions & 77 rootstocks evaluated (385 scions, 43 rootstocks still in progress). - Funded through government. Item of debate within IRTA but seen as strategic link to industry. 50% of funding through booklet, sponsors, seminars (more detailed data). - No recommendations – identify “interesting” cultivars (do not use word recommended and do not mention cultivars that are not suitable) Publication mentions all cultivars evaluated but only list cultivars that are “interesting”.

IRTA

ORIGIN OF NEW VARIETIES (BREEDERS AND LICENSORS)

USA (30%)	France (26%)	Italy (23%)	Spain (9%)	Other (12%)
Zaiger Genetics	INRA-Cep	CRA	Provedo	Better 3 Fruit (Belgium)
- IPS	INRA & Q.Neuf	CNR	Planasa	Nicolai Nurseries (Bel.)
Bradford Farms	ASF	CIV	Agromillora	ARC (Southafrica)
Burchell Nurseries	Star Fruits	Univ. Bologna	PSB	Next Fruit Generation (NL)
- EG THAMES	Monteux-Caillet	Univ. Pisa	Proseplan	Plant & Food Research
Univ. California	Delbard Interna.	Univ. Milano	Fruit Futur	(NZ)
Univ. Michigan	Davodeau Ligon.	A. Minguzzi		DASA (Australia)
	Pepi. du Valois	Braun Nurseries		
	Mondial Fr. Selec.	Feno Nurseries		
	Cadamon	New Plant		
	Pepinieres Gard			









IRTA

HOW MANY VARIETIES HAVE HAD A SIGNIFICANT IMPACT IN OUR FRUIT INDUSTRY?

Especie	Number of cultivars tested 1994-2014	National origin	Number of cultivars with significant impact* (not included)	% / Total
Apple	452	0	26* (5)	6% (1%)
Pear	154	0	2	1,3%
Peach	750	105	78	10,4%
Cherry	71	0	9	12,6%

*: including sports/redsports ('Gala', 'Golden', 'Red Delicious', 'Fuji'.....)

ORIGIN OF NEW ROOTSTOCKS (BREEDERS AND LICENSORS)

USA (19%)	France (21%)	Italy (28%)	Spain (16%)	Other (26%)
Univ. California	INRA-Cep	CRA (Rome)	CITA-GA	HRI (Un. Kingdom)
Cornell-Geneva (G)	Cadamon	CRA (Forlì)	CSIC	BRNO (Txequia)
Univ. Oregon	Davodeau-Ligo.	Univ. Pisa	Certiplant	Skierniewice (Pol.)
	Pep. Valois	Univ. Bologna	Agromillora	Michurin (Ru. Fed.)
	Pep. Castang	CIV	CSIC-Agromil.	
	Star Fruits	FENO		



METHODOLOGY: CULTIVAR EVALUATION

- 6 trees for pipfruit, 3 for stone fruit
- Same rootstock
- 5-7 years assesment for stone fruit varieties, 7-9 for pip fruit varieties, 10 years for rootstocks
- Two levels of trials (apple & pear): Stage A, Stage B



METHODOLOGY (ASSESSMENTS)

AGRONOMICAL PERFORMANCE

Blooming period (Fleckinger & Bagglioni)
 Density of blooming (peach)
 Fruiting type
 Yield
 Tree vigour (TCSA)
 Yield Efficiency
 Return bloom
 Sensitivity to the main diseases: scab,
 powdery mildew

FRUIT QUALITY

Fruit size
 Fruit weight
 Fruit size distribution
 Fruit colour
 Soluble Solid Content (SSC)
 Titratable Acidity (TA)
 Starch Index (apple)
 Harvest window
 (Stage B, 5 harvest dates)



RESULTS OBTAINED AND DISSEMINATION



TRANSFERÈNCIA DE INFORMACIÓ AL SECTOR: JORNADES IRTA-2015



- Considering webpage with info – pay to access.

	• Ask permission to evaluate pre-release, but after release cultivars open for evaluation – no permission needed. • Overarching EU agreement for evaluation of all EU-bred material – through EUFRIN. • Pragmatic about number of evaluation sites – IRTA was originally asked for sites in each and every village – not economically viable. Therefore, for stone 1 site and pome 2 sites.
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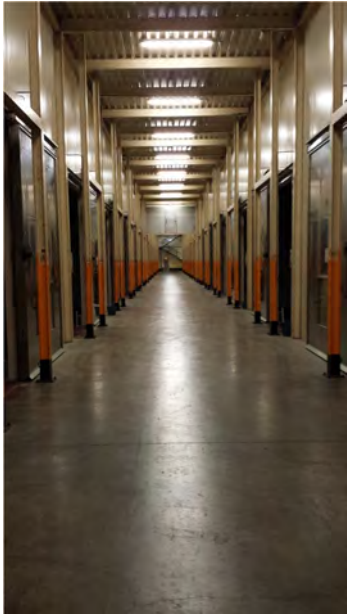


Apple seedling blocks of the IRTA breeding programme.



Peach seedling blocks of the IRTA breeding programme.

5. **NUFRI**

Company	NUFRI - http://www.nufri.com/home/en/
Host	Josep M. Benet Jordana, Technical Director Fresh Fruit (jmbenet@nufri.com)
Origin	Founded in 1975 as grower cooperative.
Composition	Producers vary in size and therefore shares
Products	- Fresh fruit - Grow & import (apple, pear, citrus & plums from SH.) 3000 ha apples, pears & peaches 700 ha new apple plantings by Nufri in Soria, central Spain (all under nets) - Mostly Golden Delicious, Royal Gala, Granny Smith (under black net), Fuji, Red Delicious. New plantings of Envy 300 ha citrus grown by Nufri in southern Spain - Fruit juice (apple, pear, citrus & peach) from 1986. - Veggies in Morocco. - Energy generation – co-generation – since 2000.
Technical Dept.	- Provides technical advice to growers. - Manages quality control 
Cultivars	- Founding member of Fruit Futur. - Member of Ifored. 2 experimental variety plots (in addition to IRTA evaluation programme). - Invest in IRTA breeding programme, but also elsewhere. - Realise that finding cultivars adapted to local conditions is a long term process. No rush – don't want to make planting mistakes – need enough data for planting decisions.
General remarks	- Growers average 7-8 ha in size. - Company has been planting own orchards. - Will support grower members in planting new Granny Smith orchards, but only if under black net. - White net provides insufficient protection against sunburn in Granny Smith.

6. Agromillora nursery.

We were not allowed to take pictures at Agromillora. However, their website - <http://www.agromillora.com/eng> - provides good background on the company and has some nice pictures and videos.

Company	Agromillora nursery
Host	Joan Torrents, General Manager (jtorrents@agromillora.com)
Origin	Established near Barcelona in 1986
International presence	Producing trees in: Oregon, California, Chile, Argentina, Brazil, Florida, Morocco, Tunisia, Turkey, Jordan, Australia
Products	Olives, almond, peach/nectarine, apricot, plum, apple rootstocks, pear rootstocks, grapes, citrus, walnuts, pistachios, pomegranates, kiwis, figs, ornamentals, etc. Currently 42% <i>Prunus</i>, 29% olives 
Size	In 2015 61 million trees. Estimated 80 million trees in 2016.
Note	• Considered expansion to SA a while ago, but didn't consider the market big enough (need to be 500,000+ trees) • Reconsidering due to their interest in avocado (Westfalia) • Provides a phytosanitary service (in glasshouse facility) similar to SAPO and DAFF plant quarantine to Catalonian government, IP owners, breeders and nurserymen • Do not sell direct to growers, only to nurseries • Have a <i>Prunus</i> scion and rootstock breeding programme – ROOTPAC series rootstocks • Supply rootstocks or micro-grafted plants • All production under controlled conditions in labs, greenhouses and under nets – for hardening off. • Highly automated production and mechanised. • Time required to produce hardened-off tissue culture rootstock: 3½ weeks. Grows for 4 weeks until grafting/budding and another 4 weeks to sell as Smarttree®.

7. Certiplant, Grard Iberia SL & VIVERSA Nurseries

Certiplant	• http://www.nufri.com/nurseries/en/ • Contact – Oriol Belil Boladeras, Director (certiplant@certiplant.com) • Nufri's nursery • Stone and pome • Stone fruit – tissue culture plants in greenhouse or under nets. • Do not produce apple rootstock tissue culture – used it to establish layer beds in the past and got bad results (uneven vigour). According to Agromillora, hormone levels have been decreased in the rooting media, giving much better results than in the past. In addition, the idea is to multiply rootstocks through tissue culture and not to use tissue culture material to establish layer beds.
Grard Iberia SL	• Owned by owned by Pepinieres Grard in France http://www.pepinieres-grard.com/ • Grard Maghreb SARL is subsidiary in Morocco. • Grard Iberia SL was created to meet demand for potted, micro-grafted plants. • Produces about 80,000 potted plum, peach and apricot trees per year. • We also saw a consignment of 100,000 Celina pear trees with the tissue culture rootstocks provided by Agromillora and the trees either grafted or budded. These trees would be ready to sell within 1 year. • The pots have grooves that prevent roots from circling the circumference of the pots and becoming pot-bound. • Special pot trays keep the pots off the ground, which is overlaid with plastic. • The trees are in a glasshouse and/or also under nets. Trees are fertigated.
VIVERSA	• http://www.viversa.es/en/nursery.html • Produces about 8,000,000 stone fruit trees per annum. Only produce trees in virgin soil – will use pots if virgin soil is not available. • Mostly tissue culture rootstocks because of greater efficiency (especially with difficult to root rootstocks) and tree health. • Considering moving operations to south of Spain near Murcia to be able to increase production cycles per year. • Also considering moving operations to net houses and in pots for reasons of tree health. • Have planted tissue culture M9 – see increased vigour.



These Celina pears at Grard Iberia SL nursery are part of a batch of 100,000 trees. The tissue culture BA 29 rootstocks were delivered by Agromillora and then either budded or grafted with BH interstem and then to Celina scion by the nursery. Note the stands on which the pots rest and the full floor coverage – great sanitation! The trees will reach 1.8 to 2 m before delivery to the customer in late autumn.



Grooves in the pots prevented the roots of the pear trees to circle in the bottom of the pot.



Peach trees at Grard Iberia SL nursery ready for planting – planting takes place in late spring or early autumn. The trees were provided as micrografted plants by Agromillora.



Tissue cultured Garnem rootstocks nearly ready for budding at VIVERSA nursery. Tree loss has been negligible.

8. Take home lessons

Lessons learnt	Recommendation and action
1. <u>Plant material (nursery trees).</u> • Control of mother material (rootstocks and scions) used very strict. • For stone fruit, tissue culture is the way to go due to the following advantages: ○ Ease of propagation of difficult to root rootstocks. ○ Reduced pest and disease risk ○ Efficiency gains (time & volume) • Tissue culture has much potential for crops like apple and pear for the same reasons as mentioned above. • Producing trees in pots have distinct advantages: ○ Better establishment performance due to less transplant shock ○ Reduced pest and disease risk ○ Greater uniformity of product ○ Can plant trees at different times of the season including with leaves	• Our fruit and nursery industries need to review our nursery practices. • Identify and address (collectively as industry) red tape bottlenecks that hamper importation of tissue culture rootstocks/ plants. • Promote the production of difficult to root rootstocks (particularly stone fruit) through tissue culture as industry strategy.
2. <u>Cultivar evaluation</u> • Very few cultivars are eventually successful and IRTA's evaluation programme significantly reduces the risk to growers. • Two systems are possible: • IP owner doesn't pay for evaluation and information is made accessible to growers – this is the method followed in Spain. • IP owner pays for evaluation but information is not readily accessible to growers – this is the envisioned local method. • It is impossible to evaluate cultivars of all fruit types in all areas.	• Industry has to temper expectations regarding the evaluation of all cultivars at all sites. Pragmatic choices will need to be made. • Considering that information will not be readily available to growers, industry will require a very strong communication drive to inform growers of how they can “push” cultivar owners for the required information. • Industry should continue investing in

	rootstock evaluation to keep this information accessible to the entire industry. • The apple industry should consider investing in evaluation of clones – this information should preferably be readily available to all growers considering that the main “movement” in planting of new material in the apple industry has revolved around improved clones.
3. <u>Breeding.</u> • Breeding objectives need to be very specific. • There are many very good breeding programmes in the world. • The ARC pome and stone fruit breeding programmes are not operated according to best practice – in terms of management of seedling blocks and evaluation sites (Phase I and II).	• Industry should carefully consider whether its needs are best addressed through investment in breeding programme(s), sourcing or a combination of both. • Where industry invests in breeding, the goals should be very clear, very specific and the project managed and evaluated on an outcome basis – where the outcome is provision of cultivars that can be recommended for planting after stringent independent evaluation.

Appendices 1

Contacts:

IRTA <http://www.irta.cat/en-US/Pages/default.aspx>

- Joan Bonany, Director of Pip & stone fruits subprogram
- Dr Simó Alegre, Fruitcentre Director
- Dr Celia Cantin, Pome fruit breeder
- Dr Ignasi Batlle, Stone fruit breeding
- Dr Luis Asin, Rootstock breeding & Horticulture
- Ignasi Iglesias, Scion & rootstock evaluation

Nurseries

- **Agromillora**, <http://www.agromillora.com/eng>
Joan Torrents, General Manager
- **Certiplant**, <http://www.nufri.com/nurseries/en/>
Oriol Belil Boladeras, Director
- **Grard Iberia SL**, <http://www.pepinieres-grard.com/>
- **VIVERSA**, <http://www.viversa.es/en/nursery.html>
Josep Sancho Perpinyà

NUFRI <http://www.nufri.com/home/en/>

Josep M. Benet Jordana, Technical Director Fresh Fruit

Appendices 2

The final tour itinerary was as follows:

Sunday 15th of May

Arrival into Barcelona

Overnight in Barcelona

Monday 16th of May

Holiday in Catalonia – Joan forgot that this was a public holiday.

Overnight in Barcelona

Tuesday 17th of May

8:30 Pick up at Hotel NH Eixample

9:30 Visit to Agromillora nursery

Lunch

15:00 Trip to Lleida

17:00 Arrival to Lleida

IRTA people concerned: Joan Bonany

Overnight in Lleida

Wednesday 18th of May

9:00 IRTA-FruitCentre Introduction to IRTA and Deciduous fruit research program. Joan Bonany Apple, pear and peach fruit breeding programs at IRTA. Introduction. Joan Bonany Apple, pear and peach fruit breeding programs at IRTA. Objectives, methods and progress. Celia Cantin, Ignasi Batlle Pear rootstock breeding program at IRTA. Luis Asin IRTA people concerned: Celia Cantin, Ignasi Batlle, Simó Alegre, Luis Asin, Joan Bonany

Lunch

15:30 Visit to Gimenez field station. Visit to breeding programs, rootstock evaluation and peach cultivar evaluation plots IRTA people concerned: Celia Cantin, Ignasi Batlle, Simó Alegre, Luis Asin, Ignasi Iglesias, Joan Bonany

Thursday 19th of May

9:00 IRTA-FruitCentre Cultivar evaluation program. Ignasi Iglesias Rootstock evaluation program. Ignasi Iglesias Activities on crop technology. Luis Asin Visit to Mollerussa field station IRTA people concerned: Ignasi Iglesias, Luis Asin, Simó Alegre, Joan Bonany

Lunch

15:00 Time for further discussion on breeding program IRTA people concerned: Simó Alegre, Joan Bonany

Friday 20th of May

9:00 Visit to NUFRI (member of Fruit Futur)

11:00 Visit to Certiplant Nursery (apple, pear, peach nursery)

12:00 Visit to Grard Iberia Nursery

IRTA people concerned: Joan Bonany

Lunch

15:00 Visit to VIVERSA (peach nursery)

17:00 End of visit

IRTA people concerned: Ignasi Iglesias, Joan Bonany

Overnight in Barcelona

Saturday 21st of May

Departure to South Africa