

Travel Report: Visit to France and Italy

August 2022



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1. Objectives of the visits:

- To visit research institutions in France and Italy and familiarise us with their structures and research;
- To visit the Piedmont production region and growers in Trentino and South Tyrol;
- To learn what's new in the fields of tree training systems, rootstocks and cultivars;
- To acquaint ourselves with Italian and French certification schemes;
- To build relationships with researchers, technical experts, and industry members in the EU.

2. Touring party members:

- Hugh Campbell (Hortgro)
- Wiehann Steyn (Hortgro)
- Marno van der Westhuizen (Hortgro)
- Xolani Sibozza (Hortgro/Stellenbosch University)
- Karen Theron (Stellenbosch University)
- Esmé Louw (Stellenbosch University)

3. Visits in France and Italy:



A. INRAE - The French National Research Institute for Agriculture, Food and Environment

22 August 2022 – Avignon and Montpellier

More Information on the Company

- Based on the Web of Science (WOS) specialization index score, INRAE is the world's top institute for research on agriculture, food, and the environment.
- INRAE consists of 202 research units grouped within 14 research departments and has 18 research centres across France. We visited one of their research units and a research unit they're involved in.
- For more information on INRAE, visit <https://www.inrae.fr/en>

i. Visit 1



Genetics and Improvement of Fruits and Vegetables (GAFL) Research Unit – Avignon

(A research unit embedded in the Plant Biology and Breeding department)

Hosts

- Dr Bénédicte Quilot-Turion, [Deputy Director of GAFL INRAE Research Unit](#).



The touring party members with Dr Bénédicte Quilot-Turion and colleagues.

Reasons for Visit

- To visit and learn about INRAE's GAFL unit organizational structure and their stone fruit pre-breeding, evaluation, and production processes at the Provence-Alpes-Côte d'Azur research centre in Avignon.
- For more information, visit the GAFL website - <https://www6.paca.inrae.fr/gafl/>

Observations

- GAFL consists of more than 50 employees of which 12 are researchers. The developmental research at GAFL is fully funded by the French government.
- GAFL has two main scientific objectives:
 1. To contribute to durable pesticide reduction with the use of genetics;
 2. To promote the use of genetic diversity.
- GAFL's research process include the following:
 - **Conserve and characterise biological resources and bi-annual evaluation:** The unit houses rich collections of fruit species from genus *Prunus* (apricot, almond, peach and stone fruit rootstocks).
 - **Elaboration and validation of tools, tests, and procedures for breeding selection methodology.**
 - **Pre-breeding:** The unit does not breed for end cultivars, but rather pre-breed for multi-gene resistance to pests and diseases and immunity to abiotic stresses.
- The selection material and technology that GAFL develops are passed on to the private sector (CEP Innovation, experimental stations, and private breeders) for varietal creation. The French government thus funds the implementation of breeding technology through the private sector.
- Subsequent royalties on new cultivars are shared between the private companies and GAFL.
- Their targets for resistance per fruit type are as follows:

Apricots	Peach	Rootstock
Sharka ¹	Sharka ¹	Root-knot nematode ⁸
Bacterial canker ²	Green peach aphid ⁵	
Monilinia on flowers ²	Powdery mildew ³	
Rust ²	Monilinia on fruit ⁶	
Powdery mildew ³	Leaf curl ²	
Apricot chlorotic leafroll phytoplasma ²	Bacterial spot (<i>Xanthomonas</i>) ²	
Low chemical inputs ⁴	Fusicoccum ⁷	
	Low chemical inputs ⁴	

¹ Specific greenhouse; ² Orchard; ³ Orchard/Insect-proof; ⁴ Multi-site orchards; ⁵ Tunnel; ⁶ Orchards/lab; ⁷ Orchards + tunnel and ⁸ Lab

➤ MAS

TRAIT	Major genes			QTL		Nb of linkage groups	Total
	SSR	SNP	Gel	SSR	SNP		
Resistance							
Green peach aphid	2	1		2	4	3	9
Powdery mildew	2				4	2	6
Nematodes_Peach		1					2
Nematodes_Almond		1					
Xanthomonas					7	2	7
Leaf curl				4		2	4
Fusicoccum				2		2	2
PPV_Apricot					3	1	3
Agronomy and Quality							
Autofertility_Apricot			1				1
Autofertility_rootstock			1				1
Peach foliar nectaries		1					1
Bloody flesh		1					1
Weeping habit		1					1
Nectarine / peach			1				1
Flesh color white / yellow	1	1	1				3
Round / flat fruit shape	1						1

GAFL has developed a wide range of genetic markers for both horticultural/quality and resistance traits, including a marker for Aramis® - a Plum Pox virus (Sharka) resistant apricot.

- General observations:
 - GAFL has several MSc and PhD projects but shares our challenge in keeping students in research as more and more students opt for a job in the private sector.
 - With a strong drive for lower chemical inputs, the French government has implemented an immediate zero herbicide policy within the INRAE group. They currently depend mostly on mechanical weeding. The aim for the producers is to be herbicide free by 2024.
 - INRAE breeding strategy shifted from focusing on varietal breeding (developing new commercial varieties) to pre-breeding. This means that INRAE is not using taxpayers' money to compete with private enterprise. Rather, they are utilising their scientific knowledge and government funding to focus on developing disease resistance which then can be bred into commercial cultivars by private companies. This is the case for both pome and stone fruit.

ii. Visit 2



Genetic Improvement and Adaptation of Mediterranean and Tropical Plants (AGAP) – Montpellier

(A Joint Research Unit between Cirad, INRAE and Montpellier SupAgro)

Hosts

- Dr. Evelyne Costes, INRAE Senior Researcher in the Architecture and flowering of fruit species (AFEF) team of AGAP.
- Professor Emeritus Jean Luc Regnard, Agronomic sciences, Biology and Ecology Department, SupAgro.



The touring party members with Prof. Jean Luc Regnard and Dr. Evelyne Costes.

Reasons for Visit

- To visit AGAP's resource centre in Montpellier, where they focus on the natural apple tree architecture and the impact of climate change.
- To connect with and introduce Esmé Louw to Dr Evelyne Costes, who's known for her research on fruit tree architecture and its genetic control and the environmental control of flowering time.

Observations

- We visited a trial where AGAP evaluated the genetic variability in apple tree architecture and

light interception response to increasing soil drying. The researchers combined the high-throughput phenotyping and genome-wide association studies on an apple tree core collection of about 241 cultivars, consisting of French local and old dessert apple cultivars.

- The experimental trees were planted in 2014 with two water regimes, well-watered and water deficit. The trees were unpruned, received fertilisers and were manually thinned to one fruit per cluster. Tree architecture, canopy shape, light interception, vegetative traits, and transpiration were monitored.
- The result: large phenotypic and genetic variability were observed for all traits, especially canopy surface temperature, in both well-watered and water deficit conditions. The researchers concluded that the control of water loss is largely dependent on genotype.
- The orchard has not been manipulated (no pruning or thinning) after the completion of the abovementioned trials for a new research objective set at identifying phenotypic traits and markers linked to self-thinning and a regular bearing habit without the need for chemical/hand thinning.



The experimental site in Montpellier.

- **General observations:**
 - It was interesting to observe the natural growth habits of the apple trees without manipulating the tree architecture.
 - The most common noticed growth habits varied from spur type to terminal bearing, upright to weeping and various degrees of blind wood formation and basal dominance. Genotypes varied in frequency of bourse-over-bourse fruit bearing and alternate bearing.

For more information, visit the AGAP website - <https://umr-agap.cirad.fr/>

B. Sanifrutta Cooperation

23 August 2022 - Saluzzo

Hosts

- Alberto Boschero, Technical Collaborator, Sanifrutta.
- Alex Tallone, Technical Manager, Sanifrutta.



The touring party members with Alberto Boschero, on their way to visit the stone fruit packhouse.

Reasons for Visit

- Sanifrutta is one of the leading grower groups in the Piedmont region, responsible for collecting, processing, packaging, and marketing fresh fruit. Sanifrutta has a strong technical team that keeps the company at the forefront of innovation. Alex Tallone has also previously visited growers in the EGVV region and can relate to our local challenges.
- Graeme Krige had previously visited Sanifrutta and suggested to Wiehann that it would be worthwhile to visit the group.

More information on the Company

- Sanifrutta Cooperation was established in 1989 by 9 farmers. By 1998, the Sanifrutta family had 65 farms with more than 400 ha in production.
- Their products include apples, cherries, kiwis, plums, peaches, and nectarines.
- By 2020, they had 1980 ha in production, produced 55 459 tonnes of fruit and generated revenue of 42 million euro.
- For more information, visit the Sanifrutta website - <https://sanifrutta.com/>

Observations

Production

- 60% of their production is apples, of which 40% are Royal Gala strains, 30% are Red Delicious, 15% are Crimson Crisp, 10% are Fuji and 5% are Granny Smith and others.
- 98% of their Japanese plum production is Angeleno.
- The average farm size is between 10 - 15 ha, with the biggest farm being 60 - 70 ha. According to Alberto, a hectare of production land can sell for "more or less" €100,000 - €150,000! Thus, a lot of small farms.
- It was interesting to note the difference in the inheritance of farms between the Piedmont region and South Tyrol. In Piedmont, the farm gets split between the children of the owner, if they want it, whereas in South Tyrol the full farm is inherited by the oldest child.
- Their main rootstock is M.9, but they're also planting G.11 and G.41. In terms of training systems, most trees are trained to a slender spindle, with a few trained as a Bibaum®.
- 85% of the production area is covered with permanent shade netting, even the plums.
 - The shade nets are all retractable for reproductive development, and to open in winter for the snow.
 - Mainly white and black nets are used, but there is no restriction on the colour of the netting.
 - They find that a black net has a longer lifespan of $\pm 15 - 18$ years compared to white with a 10 - 12-year lifespan.
 - Their primary motivation for shade netting is similar to ours: cost effective management of risks, as it hails every year and insurance is too expensive.

Quality

- The average apple yield ranges between 50 - 80 tons/ha, of which 75 - 90% are export grade.
- They also cannot farm for juice: 4 - 5 euro cents/kg for juice compared to 30 - 40 euro cents/kg and 70 - 80 euro cents/kg for apples and stone fruit, respectively.



Example of one of Sanifrutta's good performing orchards.

Labour

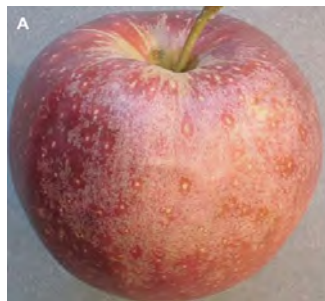
- They rely heavily on harvesting platforms and Harvista™ (although it is not yet registered for the current season) as labour is expensive ($\pm$ €80 - 90 per day per picker).
- ReTain® is not yet registered in Europe. K Theron indicated that ACC is in the process of registration as a late thinning agent for apples. The Italians, however, are not optimistic that any registration will happen anytime soon. They noted that it takes 4-6 years to get a new chemical registered.



Example of the harvesting platform in Saluzzo.

Biggest pre-harvest challenges

- For the past 5 - 6 years, they've been struggling with white Pantina, an imperfection of the peel associated with symptoms of russetting caused by a yeast-like fungus, Tilletiopsis.



Example of white Pantina symptoms.

Source: Weber, R.W.S. and Zabel, D. 2011. White haze and scarf skin, two little-known cosmetic defects of apples in northern Germany. Europ. J. Hort. Sci., 76 (2): 45-50.

- Cracking on Royal Gala strains.
- Brown marmorated stink bug damage.
- Monilinia in plums.

- They do not consider replant as a major issue yet and do not and cannot fumigate the soil.

Post-harvest

- They are busy building a new “vertical” packhouse with 3 levels:
 - Level 1 - Pre-sorting
 - Level 2 - Packing
 - Level 3 - Packaging material and offices
- They have a strong drive to use minimal plastic in the packaging material.
- They also make use of DCA and ULO storage.
- Fludioxonil is only applied after harvest on the farm before the fruit is transported to the packhouse.

- The Sanifrutta technical team and 30 growers will be visiting South Africa in January 2023. If their schedule allows, W Steyn and A Tallone will arrange a meeting to visit Hortgro Science and potentially view some of the Pro-Hort/Adaptability trials.

C. Agrion Foundation

24 August 2022 - Saluzzo

Hosts

- Luca Nari, Researcher and Technical Advisor.
- Dr Davide Nari, Researcher.
- Dr Lorenzo Berra, Scientific and Technical Coordinator



The touring party members with Davide Nari (2nd from left,) Lorenzo Berra (behind Wiehann) and Luca Nari (far right.)

Reasons for Visit

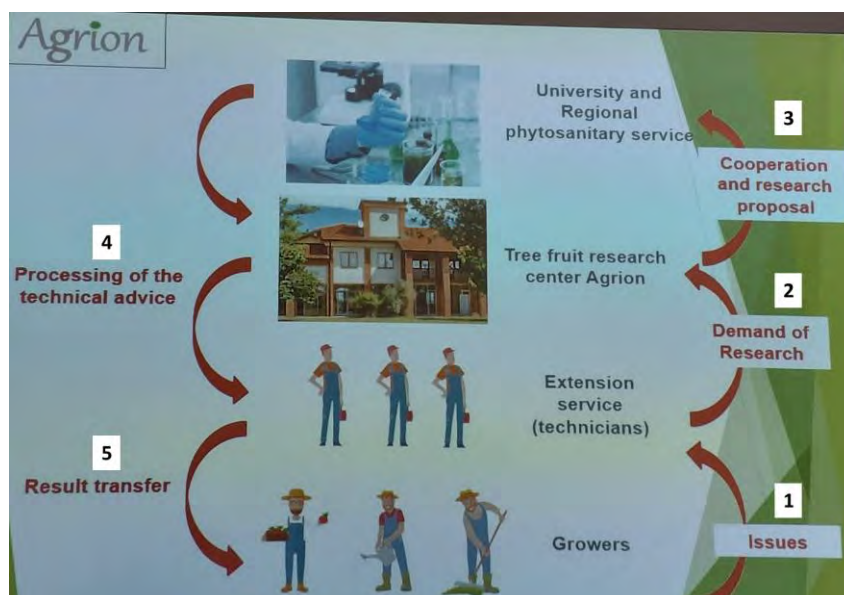
- Agrion is the official fruit, vegetable, berry and grapevine applied research centre of Piedmont (North-West Italy). Graeme Krige also recommended that we visit them, given that they fulfil a similar role to Hortgro Science for the Piedmont growers.
- They're situated near Sanifrutta, so we could arrange a late-morning visit to learn about their structures and research needs; and discuss their current applied research on rootstocks, cultivars, and training systems.

More information on the Company

- For more information, visit the Agrion website - <https://www.agrion.it/>.

Observations

- Agrion is a public company fully financed by the Piedmont region.
- They have 25 employees, which includes technicians, researchers and 6 administrative staff. They also host students during the summer.
- They have a similar research structure to ours - see the image below. They identify the research gaps through the technicians, conduct the research in-house or outsource it to universities, and transfer the findings back to the grower. Like with our structure, their process relies heavily on the active involvement of technical people.



The research structure of Agrion.

• Technology Transfer:

- Agrion hosts weekly 1 – 2h meetings with the technical grouping of the region to discuss timely aspects, issues, etc. (similar to the Fieldmans/Store-It/IPM meetings). This is also an opportunity to share and discuss the relevant research results. Following each meeting, Luca prepares a newsletter containing information such as the IPM strategy, which is then circulated to the growers/technicians.
- They implement regional monitoring plans for all growers.

• Varieties and Rootstocks:

- Agrion has 8 ha available for evaluation with more than 800 varieties for selection across all fruit types.
- Evaluations are funded by interested growers and marketers.
- Apple scab-resistant varieties that they are looking at are Inored (Story®), Smeralda, Inogo (Lory®) and Inolov (Mandy®).
- They've also noted that the claimed resistance of Geneva rootstocks to woolly apple aphid does not necessarily apply to them because of different strains of the insect.

D. Fondazione Edmund Mach (FEM)

25 August 2022 - Trentino

Host

- Tommaso Pantezzi, [Head of the Fruit and Berry Growing Unit, FEM](#)



The touring party members with Tommaso Pantezzi (red shirt) and FEM's rootstock (Jonathan Pasqualini) and training system (Franco Micheli) researchers.

Reasons for Visit

- FEM is a well-known agricultural institute in the Trentino region with 3 main departments:
 - Training and Education
 - Research and Innovation
 - Technology Transfer
- We started the morning at the campus to learn more about their structure and research. Next, we visited their experimental farm to view their rootstock and training system trials. In the afternoon, we visited orchards in Trentino with some local growers and one of FEM's extension officers.

More information on the Company

- The institution was founded in 1874 and consists today of 70 ha production land and a 14-ha campus that hosts school facilities, greenhouses, offices and laboratories.
- Their research includes apples, grapes, cattle, and fish farming.
- They're known for sequencing the genomes of apples and grapevine.
- For more information, visit the FEM website - <https://www.fmach.it/eng>.

Observations

- Their training system trials were started by the tree training system specialist, Alberto Dorigoni, who presented at the Hortgro technical symposium in 2019. They started by looking at Bibaum® and 3-4 leader trees and have now shifted their focus towards trees with no permanent leaders, such as the guyot.
- We viewed a guyot system with Gala on M.9 T337 with the following details:
 - They work on a 5 fruit per 50 cm spacing on each upright.
 - With the flat training of the trees and the narrow row width (2.25 m), they aim for a tree height of 110% of the row width + 40 cm.
 - Aim for 80 tons/ha with $\pm 90\%$ export grade.
 - They don't use PGRs to manage the balance between the growth of the different leaders, only knife cuts/girdling.
 - It was interesting to note that FEM researchers and Trentino growers believe that strong leaders on a guyot must be renewed. Laimburg researchers and South Tyrol growers, however, believe that upright leaders must be kept for as long as possible (up to 8 years). Trentino guyot trees have more, thinner leaders while Tyrolian guyot trees have fewer, thicker, permanent leaders at a wider spacing.



Gala on M.9 T337 rootstock, trained to a guyot system.

- Most farms ($\pm$ 500 growers) in Trentino are 1 ha in size, with the largest farms being between 10 and 15 ha. According to Tommaso, you need at least 5 ha to survive, so most growers have 2 or more jobs.
- Due to the high price of production land, they ensure that the limited area is planted optimally, even on the roundabouts.
- We observed dead trees in a rootstock trial on G.935 rootstock. It is claimed that the trees died due to the presence of viruses in the scion material.
- Marmorated stink bug is a major pest, and we saw plenty of fruit damage at the experimental farm.
- Apple proliferation phytoplasma is a major disease that does not kill trees but significantly reduce production and fruit size.
- FEM is trialling a pedestrian guyot concept orchard with row widths of 2.25 m - 1.2 m - 2.25 m. Trees on each side of the 1.2m are trained to be only harvested on the outside. Although the 2.25 m will be challenging for us, it was interesting to note that there is still ample light penetration between the 1.2 m spaced trees.



The pedestrian guyot concept orchard.



SweetTango apple. A very nice tasting apple, but unfortunately hard to determine the maturity due to full red colour.



Example of the 1 ha farms in Trentino. Each block could be a different farm.

E. Laimburg Research Centre and Beratungsring

26 August 2022 – Bolzano, South Tyrol

Hosts

- Dr. Walter Guerra , Head of Institute for Fruit Growing and Viticulture, Laimburg Research Centre.
- Christian Andergassen, Group Leader: Fruit Physiology, Institute for Fruit Growing and Viticulture, Laimburg Research Centre.
- Dr. Irene Höller, Researcher, Laimburg Research Centre.
- Paul Pernter, Technical Advisor, South Tyrol Beratungsring.



The touring party members with Dr. Walter Guerra.



The touring party members with Paul Pernter.

Reasons for Visit

- Laimburg is a world-renowned research centre for agriculture in South Tyrol. As they are at the forefront of innovation, it was a good opportunity to learn what's new in the fields of tree training systems, rootstocks, and cultivars; and build relationships for potential future collaborations.

More information on the Company

- Laimburg is an applied research centre, agricultural school (learners from 14 years) and plant protection centre (like plant disease clinic).
- Research at Laimburg is organised in four institutes:
 - Institute for Fruit Growing and Viticulture
 - Institute for Plant Health
 - Institute for Agricultural Chemistry and Food Quality
 - Institute for Mountain Agriculture and Food Technology
- More than 150 employees work on approximately 350 research and experimental projects.
- 80% of Laimburg's funding comes from the province.
- For more information, visit the Laimburg website - <https://www.laimburg.it/en/default.asp> or view their report - https://www.laimburg.it/downloads/Laimburg_Report_2018-2019_EN_web.pdf

Observations

General information on South Tyrol production:

- South Tyrol has 18500 ha of apples, producing ± 1 million tons/ha/year (compared to ± 1.5 million tons/ha/year in Trentino). South Tyrol contributes $\pm 10\%$ of the apple production in Europe.
- The average farm size is 2.5 - 3 ha with the price of a m² ranging between €50 - 130. Due to the high price of land, growers plant as many trees as possible on the available area, optimise the spacing and use training systems that allow for taller trees.
- The 2 main marketing companies are VOG (main cultivar is Gala) and VIP (main cultivar is Golden Delicious).
- Three new club varieties are getting planted in the region: Ipador - Giga™, Story® - Inored and WA 38 / Cosmic Crisp™.
- Pink Lady® is the most lucrative apple in the region.

Training systems for apple

- Christian Andergassen gave us a tour of his training system and thinning trials and shared some good information and results.
- They are mainly planting M.9 T337 rootstocks, but are looking at alternative options due to the replant risk (they're now at the 3rd generation of apple trees on the same soil).

- Approximately 80% of their orchards are under shade nets for primarily hail protection. Unlike Trentino, South Tyrol has a regulation in place that only allows the growers to use full grey or black shade netting.
- We viewed two guyot vs Bibaum® trials - for interest sake, see results below:
 - Cultivars - Fuji and Royal Gala
 - Rootstock - M.9 T337
 - Shade net - 20% Black net

Fuji Training System Trial				
Training System	Bibaum®		Guyot	
Tree spacing (m)	2	2.5	2	2.5
1 st leaf	0	0	0	0
2 nd leaf	38.5	38.5	8	6
3 rd leaf	52	53	62	52
4 th leaf	70	56	85	77
5 th leaf "prediction"	161	144	155	136

Royal Gala Training System Trial				
Training System	Bibaum®		Guyot	
Tree spacing (m)	2	2.5	2	2.5
1 st leaf	0	0	0	0
2 nd leaf	25	20	18	14
3 rd leaf	38	35	28	22
4 th leaf	52	42	48	44
5 th leaf "prediction"	116	100	95	80



Example of the Bibaum® (left) and guyot (right) training systems.

- He indicated two big disadvantages of a guyot system:
 - Given that you plant fewer trees with a guyot system, you risk losing more production when something like Fire Blight attacks the orchard, compared to when you use a spindle system.
 - It requires a lot of tree training (up to 200 - 300 hours extra for training in the first and second year).

However, in the case of Cripps' Pink (Pink Lady®), they are only allowed to plant 1000 trees per grower, with no limitations on the size of the planting. In this instance, a guyot system is advantageous as you will cover more hectares and have a higher production of Pink Lady® than with something like a spindle without compromising red colour development.

- He emphasised the importance of starting off with good quality planting material when working with multi-leader trees. With an intensive system like a guyot, it's vital to fill the allocated space as soon as possible.
- Christiaan indicated that there are two main types of orchard systems: vertical and horizontal. The vertical system, like the guyot, appears to be the best orchard system as it works with the natural growth habit of the trees. The horizontal system, however, is working against the natural growth habit of the tree and makes for much more manipulation/work.



Example of the vertical system (left) and horizontal system (right).

Rootstocks

- Laimburg's rootstock evaluations indicate that under their circumstances:
 - G.11 rootstocks induce stronger growth and higher productivity than M.9 rootstocks.
 - G.969 is overly vigorous and comparable to M.7.
 - The rootstock M200 is promising and comparable to G.41 in size, but more vigorous and productive than M.9 and G.11.
- The effect of rootstock on tree vigour can vary depending on the variety.



Clear difference in vigour between 6th Leaf G.969 trees (left) versus M.9 T337 trees (right).



Trees on G.41 rootstocks produce large leaves...



Dead G.935 tree, possibly due to its susceptibility to latent viruses in the scion.

Nursery Trees, Evaluation and New Varieties

Nurseries

- Italian nurseries produce approximately 15 million apple trees per year. The production, however, is not in South Tyrol due to the cost and the presence of quarantine diseases like Fire Blight and phytoplasma.
- They do have a certification scheme, but struggle to convince nurseries to join the scheme as certification is not the grower's first concern. According to Walter, the grower first wants to know what cultivar, followed by what is the physical quality and price of the tree and then lastly worries if it is certified or not. Trees that are exported, however, need to be certified and exported to several countries around the world, including North Korea and Russia.
- Trueness-to-type is not an issue on mutants as they have 800 DNA-fingerprints on their database. Like with our rootstock trials now, they also DNA-test the rootstocks before planting

due to mix-ups in source material.

- They test for trueness-to-type and viruses at the following levels:
 - On a model plant in a greenhouse, and in parallel, on four trees planted outside (for each model plant, there are four trees planted outside);
 - In the foundation block at a different location by inspectors;
 - In the budwood orchards by inspectors.

Evaluation and New Varieties

- The main purpose of the cultivation programme is to reduce the risk for the grower and the breeder.
- Laimburg tests about 300 apple hybrids per year, of which only 10 go to the corporates (SK) for further evaluation (pre-and post-harvest recipes, adaptability in different environments, market research, etc.).
- Walter identified the following as gaps to be filled with apple breeding in the future:
 - Snack apples, scab-resistant apples that can store long term, red flesh apples (they're testing 67 of them), cider apples, hypoallergenic apples, seedless apples, low chill apples and disease-resistant apples as the available chemicals are becoming fewer and fewer.
- An App, similar to TerraClim, was developed to provide growers with suitability maps for Pink Lady at different locations.

Paul Pernter - South Tyrol Beratungsring

- The Beratungsring is the largest fruit and wine growing private, but non-profit advisory organisation in South Tyrol. They are an independent advisory group of 50 people working on the production of apples, grapes, apricots, and cherries.
- Paul showed us some commercial orchards in the region. The level of innovation of Laimburg's experimental orchards was evident in the commercial orchards.

4. Take Home Lessons:

Lessons learnt	Actions
Collaborations - There is a definite overlap in research between South Africa and the EU on: - The effects of climate change on deciduous fruit production - The EU is experiencing higher temperatures than normal in key apple growth stages. Their research is therefore becoming more and more focused on how to produce fruit in warmer climates – something we are familiar with. - Loss of key chemicals. - Tissue culture trees versus stool bed trees – The EUFRIN group is planting a trial in 2023 that's looking at the performance of tissue culture trees versus stool bed trees. - Apple replant disease	- E Louw and X Sibozza has exchanged contact details with Dr. Evelyn Costes for potential future discussions/collaborations. - Hortgro Science to consult with EUFRIN members, K Theron and I Labuschagne, on the progress/results of the TC vs Stool bed trial.
Training Systems - Innovation in terms of training systems was evident throughout the EU. - The two-dimensional, high-density plantings play a major role in the 70 – 90% export percentages the EU growers attain. The simple canopy structure of a single leader slender spindle or multi-leader tree results in improved fruit quality by allowing for: - Ample light interception and distribution, even when the tree height goes above 100% of the row width; - More uniform maturity as there is no “inside” and “outside” fruit anymore; - Much easier pruning, thinning, harvesting etc. - The guyot system has potential as it permits the vertical natural growth habit of apple trees, compared to the traditional horizontal systems that work against the natural growth habit. Trials from FEM and Laimburg clearly illustrated that although it's an intensive system,	- M vd Westhuizen to incorporate learnings from the EU visit in the Hortgro Concept Orchards programme. - Christian Andergassen would be of great value as a speaker on new/ innovative training systems at the next Hortgro Technical Symposium in 2024 (he indicated that he is keen to attend the symposium).

with a lot of extra manipulation required in the initial years, the advantage, in the end, outweighs the initial investment. However, it's relatively new for us and certainly comes with its challenges under our conditions. Some key factors we'll need to consider are how to optimally train the trees in the initial years and what rootstock to use for such a multi-leader tree. Also, it might prove difficult to obtain sufficient breaks on the leaders under South African conditions. ● We are not far behind when it comes to innovation and already have some innovative single and multi-leader orchards in the ground. Some of these orchards will form part of the Demo Orchards in the Hortgro Concept Orchard programme.	
Rootstocks ● Rootstock evaluation is increasing in Europe to address specific challenges like apple replant disease, woolly apple aphids and latent viruses. ● M.9 is still the primary rootstock in EU. ● G.11 and G.41 are looking promising under EU conditions and could be alternatives to M.9 in replant situations. ● Great phenotypic plasticity on G.969 under European environmental conditions versus the South African conditions was observed. ● This trip again confirmed the importance of evaluating rootstocks in multiple environments.	● X Sibozza has exchanged contact details with Dr. Irene Höller for potential future discussions/collaborations.
New Cultivars ● Future apple cultivars will include apple scab-resistant cultivars, improved low chill cultivars with good colouration for the warm winter regions, superior taste and texture cultivars, varieties for diabetics and snack cultivars for children. With the increasing pressure on the use of chemical fungicides, disease-resistant apples will also become a focus. ● The number of apple breeding programmes funded by private organisations is increasing. ● Traditional apple cultivars such as Golden Delicious, Red Delicious, Gala, Granny Smith and Fuji will continue to be grown worldwide.	● Provar (Iwan Labuschagne) has a strong link with Laimburg Research Centre through his connection with Dr. Walter Guerra. Hortgro Science to consult I Labuschagne on any new developments in the cultivar evaluation programme at Laimburg Research Centre.

5. Appendix 1: Contacts

1. Inrae - <https://www.inrae.fr/en>

- Genetics and Improvement of Fruits and Vegetables (GAFL) Research Unit, Avignon - <https://www6.paca.inrae.fr/gafl/>
 - Dr Bénédicte Quilot-Turion, [Deputy Director of GAFL INRAE Research Unit.](#)
- Genetic Improvement and Adaptation of Mediterranean and Tropical Plants (AGAP), Montpellier - <https://umr-agap.cirad.fr/>
 - Dr. Evelyne Costes, INRAE Senior Researcher in the Architecture and flowering of fruit species (AFEf) team [of AGAP.](#)

2. Sanifrutta Cooperation, Saluzzo - <https://sanifrutta.com/>

- Alex Tallone, Technical Manager.

3. Agrion Foundation, Saluzzo - <https://www.agrion.it/>

- Dr Lorenzo Berra, Technical and Scientific Coordinator
- Luca Nari, [Researcher and Technical Advisor](#)
- Davide Nari, [Researcher](#)

4. Fondazione Edmund Mach (FEM), Trentino - <https://www.fmach.it/eng>

- Tommaso Pantezzi, Head of the Fruit and Berry Growing Unit.
- Jonathan Pasqualini, [Rootstock Researcher](#)
- Franco Micheli, [Training system Researcher](#)

5. Laimburg Research Centre, Bolzano, South Tyrol - <https://www.laimburg.it/en/default.asp>

- Dr. Walter Guerra, Head of Institute for Fruit Growing and Viticulture, Laimburg Research Centre.
- Christian Andergassen, Group Leader: Fruit Physiology, Institute for Fruit Growing and Viticulture, [Laimburg Research Centre.](#)
- Dr. Irene Höller Researcher, Laimburg Research Centre.

6. Beratungsring, Bolzano, South Tyrol - <https://www.beratungsring.org/info/index.php>

- Paul Pernter, Technical Advisor.

6. Appendix 2: Itinerary

ITINERARY FOR TRIP TO FRANCE and ITALY

- 13 AUG:** Arrive in Angers.
- 14 – 20 AUG:** Attend IHC 2022
- 20 AUG:** Depart Angers to Orly Airport, Paris by train. Travel by car to Villefranche-sur-Saône.
- 21 AUG:** Travel to Avignon.
- 22 AUG:** Visit INRAE.
09:00: Avignon (Stone fruit breeding, evaluation, and production) Bénédicte Quilot
14:00: Montpellier (apple tree architecture and impact of climate change) Evelyne Costes
Travel to Aix-en-Provence.
- 23 AUG:** 06:00: Travel to Saluzzo, Italy.
12:00: Visit deciduous fruit production region Piedmont with Alex Talone of Sanifrutta Cooperation.
- 24 AUG:** 8:00: Visit deciduous fruit production region Piedmont with Alex Talone of Sanifrutta Cooperation.
09:00: Visit Agrion.
PM: Travel to Trento.
- 25 AUG:** Visit Fondazione Edmund Mach. Contact: Tommaso Pantezzi.
- 26 AUG:** Visit Laimburg Research Centre. Contact Christian Andergassen
09:00: Christian Andergassen (General Introduction Laimburg, training systems for apple, thinning trial.
10:30: Irene Höller (Rootstocks trials)
12:00: Guerra Walter (cultivar evaluation, new varieties)
14:00: Beratungsring – visit commercial orchards (arranged by Christian Andergassen)
Travel to Sankt Johann in Tirol, Austria.
- 27 AUG:** Travel by car to Franz Jozef Strauss airport, Munich.