France is honored to host the 31st International Horticultural Congress (IHC) in August 2022. This is a great event to take place at Angers in the Loire Valley. The organizing committee is aiming for a high-level scientific event that will encourage collaboration as well as the three-way connection between research, education, and industry. The IHC2022 is the best opportunity to enhance exchanges on science, knowledge, and culture between southern and northern countries.

Over one week, IHC2022 will gather more than 3,000 participants. The backbone of the congress is the series of plenary sessions and about 25 symposia. Workshops, business meetings, side events, student job dating, etc. will in addition allow participants to meet, connect, discuss and debate around a central motto: “HORTICULTURE FOR A WORLD IN TRANSITION”. IHC2022 will indeed address major topics and issues related to horticulture around four main priorities:

- Competitiveness and skills for the horticultural sectors,
- Food, health and well-being,
- Sustainability of production systems,
- Adaptation to climate hazards and mitigation solutions.

This world-class congress is a unique opportunity to discover the city of Angers and its area through a week-long rich program of social events, and also the Loire Valley, Brittany and so many French regions after the congress through various professional and touristic tours, in order to enjoy some pieces of the French “Art de vivre”, made of rich cultural heritage and creative cuisine.

A series of articles specially designed for _Chronica Horticulturae_ will set up an overview and highlight some specificities of horticulture in France¹ from this issue until August 2022. An editorial team including Agnès Grapin and Jean-Claude Maugé (AgroCampus Ouest Angers), Jean-Luc Regnard (Montpellier SupAgro), and Rémi Kahane (CIRAD Montpellier) is dedicated to finding contributors among scientists and professionals to give a taste of the French realities, specialties, challenges and research in horticulture, in the European and international context. Just a way to attract you to Angers on 14-20 August 2022!

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**Diversity of horticultural production in metropolitan² France**

France offers a great diversity of territory and landscapes that correspond to a wide range of micro-climatic situations. These production areas are associated with equally diverse sociocultural traditions and practices concerning food, healthy consumption, and well-being (Figure 1). As a result, in the sectors that make up Horticulture¹, the range of French production and products resulting from their transformation is extremely diverse. By juxtaposing fruit and vegetables, ornamental and nursery crops, plants for essential oils, and herbal, medicinal and aromatic plants (HMAP), the number of plants cultivated or harvested is estimated at more than 20,000. French plant diversity includes specific territories and origins that command more appreciated for their “well-being” effects besides their decorative interest/function.

In the context of urban sprawl, which induces a quest for naturalness, horticultural productions of the three different sectors convey very positive values for health and well-being, and resilience to climate change. Beyond the maintenance of local markets with fresh products, horticulture for landscaping and leisure is perceived to play a key role, for example by limiting urban heat island effects and greening urban spaces.

The downstream industry has made no mistake, when referring to the potential benefits of horticultural produce crossing all sectors: healthy food (“eat five fruits and vegetables each day”), health food supplements extracted from plants (booming of nutraceuticals), plant natural cosmetics, alternative medicines based on plants, etc. With a slight delay, produce from ornamental horticulture are more and more appreciated for their “well-being” effects besides their decorative interest/function.

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¹Metropolitan and overseas departments including French West Indies, Mayotte and Reunion islands.
²The data presented in this article do not include French overseas territories and departments. They also exclude the wine sector, the cider and perry industry, as well as derived alcohols and spirit drinks.
³In France, the term “horticulture” is sometimes restricted to the sectors of ornamental and nursery production. It is not the case here.
The positive current context is likely to be sustainable according to multiple general or sectoral studies analyzing consumer expectations. In the long-term however, it does not offer a perspective of profit for the sectors concerned, in particular for producers who must constantly adapt to a set of constraints through innovation.

The special issues for fresh produce

While some primary products are immediately processed on farm, the destination of many products is to be sold fresh, such as fruit and vegetables, herbs and aromatic plants, cut flowers, and potted plants. Being perishable, i.e., not easily storable or only shortly, these products also show a sensitivity to climatic conditions, more importantly than in other agricultural sectors, both in terms of supply and consumption. Moreover, competition between products or even among species is real, and substitution occurs at both the distribution and consumption stages (e.g., juice vs. fresh fruit). This situation requires permanent adaptation capacities for the upstream sector (producers), onset of reliable information networks (on markets, costs, prices), and adapted logistics organization. In view of what exists for the horticultural sector in other countries, such as floriculture in the Netherlands, French horticulturists have room for improvement in terms of economic and logistical organization and data management.

Means of production

For the most intensive production systems, horticultural companies are capital-intensive and implement high technical knowledge in cropping, adaptation to climate change or prevention of meteorological hazards, and protection against pests and diseases. As horticultural farms are labor intensive, they often have to comply with many social responsibilities within the various labor markets, while having to address imperatives of the global market.

The French horticultural production chains are characterized by contrasting environmental impacts. Heated glasshouses consume fossil oils and generate greenhouse gas. However, they can use cogeneration to optimize the energy management, and carry out integrated biological protection systems, in order to lower the use of phytochemicals. Moreover, plastics are now frequently used for mulching, covering tunnels, netting against hail or to control pests. This occurs despite most plastics being hard to recycle. Vegetable production systems have become particularly diversified, from open-field production for the processing industry, heated and lighted greenhouses, to market gardening systems in open air or under low shelters. It must be highlighted that different systems can co-exist on the same farm.

The French fruit production has evolved towards a regional specialization (Figure 3). The plantation of productive orchards has largely turned towards fresh produce markets with a strong development of integrated fruit production (IFP) as a standard. From 2000 to 2010 (according to the periodical national survey of the French Ministry of Agriculture), the national fruit potential lost 25% of its area, but was restructured thanks to new varieties better adapted to markets, and orchards managed according to the IFP principles (for apple, pear, peach, nectarine and apricot) (Figure 4). To these already common trends, some emerging goals have more recently been added such as zero pesticide residue and high environmental value.

At the same time, the organic shares of fruit and vegetables grew in production: from 2001 to 2012, the area of organic fruit production increased from 4.0 to 12.5%, while that of organic vegetables rose from 1.8 to 4.0%. This trend even accelerated between 2012 and 2016 according to the French organic agency. Such a trend can be verified at the consumption level: from 1999 to 2012, the global market for organic fruit and vegetables was multiplied by four, and was estimated to have doubled from 2015 to 2016, this segment representing nowadays about 10% of the market share (Figure 5).

The French ornamental production sector is strongly challenged by low-cost or highly organized countries. It has also experienced a concentration of companies with the disappearance of almost half of them over the last
decade. In recent years, this sector decided to restructure and create various differentiation tools (brands, certification and quality labels) in order to meet the expectations of consumers and citizens in terms of environmental, social, economic and health performance (Figure 6).

The perfume, medicinal and aromatic plant sector (PPAM) has largely benefited from the market demand for natural produce with a 40% increase in production area over the last five years. For these crops, which are mostly transformed, the specific investments focused both on cropping (mechanization) and on processing (dryers, distilleries). With the implementation of technical means that were largely lacking until the end of the 80s, the production schemes have been greatly modernized (Figure 7), reassuring the specific investments of their permanency in the national territory. For example, despite the diversity and the quality of the offer, the French fruit and vegetables sector suffers from a lack of competitiveness at export. To analyze this situation, the Ministry of Agriculture and Food mandated FranceAgriMer to identify the factors that negatively affected the agricultural and agri-food trade balance in recent years, and establish a diagnosis at national level. This analysis will be carried out by a working group under FranceAgriMer supervision, bringing together specialists in value chain economy across various ministries and professional bodies. It aims to imagine practical solutions towards a better future in terms of market share and export capacity.

Reducing the use of plant protection chemicals is one of the major issues facing producers today. Given the multiplicity of species, varieties, and growing environments, research needs are huge. Due to the rapid decline of the use of phytosanitary chemicals, the horticultural sectors set up alternative methods whose objectives are to meet the expectations of reducing the negative impacts of crop production on the environment, to develop high quality products, and to avoid horticultural producers left in technical dead ends. It should be noted that many of these crops gather modest acreages compared with other field crops such as cereals. Accordingly, the phytochemical companies invest little resources for these crops and a large part of the chemical uses are described as "minor", meaning that they result from the transposition of solutions for another crop. This work is frequently performed by technical institutes (see Table 1).

Biocontrol is now widely developed in all sheltered ornamental productions, methods (e.g., geolocation of plants, automatic detection and treatment of weeds, autonomous robots). For field crops, important work is being done on alternative techniques to chemical weed control, some using the most advanced techniques (e.g., geolocation of plants, automatic detection and treatment of weeds, autonomous robots).

For perennial perfume crops such as lavender, innovative inter-row plant cover techniques have been developed to hinder the spread of leafhoppers (Hyalethes obsoletus), vectors of the phytoplasma (Candidatus Phytoplasma solani), responsible agent for the dieback of lavender (Lavandula spp) fields. Incidentally, this work highlighted other potential vectors of the phytoplasma (e.g., Acari, Drosophila), severe pest vectors of the phytoplasma (e.g., Halyomorpha halys). Thus, although biocontrol is a real alternative to pesticides, it still needs to increase its effectiveness, by coupling its use with other levers: physical protection methods such as insect nets often installed in addition to anti-rain nets, rainproof plastic sheeting, and mass trapping.

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For field crops, important work is being done on alternative techniques to chemical weed control, some using the most advanced techniques (e.g., geolocation of plants, automatic detection and treatment of weeds, autonomous robots).
Box 1. EUFRUIT® project (3 years, 2016-19)
The project consortium consisted of 21 members, including research institutes, universities, and industrial partners who represent key parts of the fruit supply chain, from 12 European countries. Through a multi-actors approach, the EUFRUIT project (funded under the European Horizon 2020 research support program) aimed to improve the implementation of research outcomes into practical and applicable knowledge that will directly benefit the highly challenged European fruit sector. The difficulties met are of technical, sanitary or environmental nature, as well as economical (market), while the fruit sector is trying to meet the expectations of consumers and ensure the sustainability of farms. Within EUFRUIT an international knowledge platform has been created (http://kp.eufrin.eu/) on the following four thematic areas:

- Performance of new fruit varieties,
- Reduction in pesticide residues,
- Postharvest fruit quality,
- Design of sustainable fruit production systems.

It has been possible to share a complete vision between researchers and practitioners in the perspective of a reduced use of synthetic phytosanitary products, what allowed a reduction in chemical residues in the fruit and a smaller footprint on the environment.

This project has highlighted the strong development of alternative methods to chemical pesticides, be it bio-control or physical control methods (orchard netting against pests, plastic cover against diseases), or a combination of both.

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Box 2. Research and development players in the fruit and vegetable sector

- The Interprofessional Technical Center for Fruit and Vegetables (CTIFL) is the leading applied research organization in the French fruit and vegetable sector, serving the different professionals from production to commercialization. Its annual activity program is based on the sector strategic program, aligned on a budget of over 20 million Euros consisting of professional funds (extended voluntary contribution), research and experimental funds related to program grants or competitive projects (European or national calls), and private funds. CTIFL carries out activities of experiment and research, innovation transfer, economic and regulatory intelligence, training and dissemination of information and knowledge to horticultural professionals. Recognized as a competent authority, CTIFL is in charge of the control and certification of fruit propagation materials, excluding strawberry plants. CTIFL is present in the main French production basins with four regional centers, which constitute, in partnership or in association with regional experiment stations, an experiment network unique in Europe.

- Regional experiment stations: the French fruit and vegetable sector also benefits from a network of ca. 30 experimental stations located in their territories in connection with the multiplicity of species and regional issues. This historic network (80s) is of great importance because it has significant experimental capacities. It addresses regional issues linked to CTIFL and according to priority needs. The funding of these stations can be private and/or public. The proximity of producers favors a quick dissemination and transfer of results.

- Scientific interest groups (GIS): The GIS Fruits, created in 2012 with 22 partners (INRA, CTIFL, CIRAD, professional organizations, higher education, etc.), aims to contribute to sustainable development oriented innovation in fruit crops through the production of scientific and operational knowledge. It seeks to support changes in the fruit sector by triggering and promoting research, experiment, extension and training activities. The GIS PicLeg (stands for Integrated Production of Vegetable Crops) was created in 2007. It enables the development of vegetable crops and cropping systems taking into account societal expectations reconciling food quality, environmental impact, economic performance of farms and social requirements. Its field of study takes into account all modes of production (open field, soilless, greenhouse and shelters). In the framework of a ten-year agreement (2017-2027), two themes are developed: strengthening the knowledge and the design of low-input cropping systems at the plot scale, and developing new actions around diversification and organization of food systems at the scale of farms, territories and vegetable value chains.

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1https://eufrin-test2-9fy.micusto.cloud/?id=55.
<table>
<thead>
<tr>
<th>Horticultural sectors</th>
<th>Ornamental horticulture, floristry &amp; landscaping</th>
<th>Herbs, medicinal &amp; aromatic plants (HMAP)</th>
<th>Fruit &amp; vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General data</strong></td>
<td>53,000 firms (farms and companies): production, trade, landscaping</td>
<td>ca. 5,000 producers (not necessarily specialized)</td>
<td>75,000 firms (farms)</td>
</tr>
<tr>
<td></td>
<td>Jobs: ca. 170,000 employees</td>
<td>Annual sector sales: more than 5 billion € (consumption stage, variable data depending on the scope of products considered)</td>
<td>Vegetables: 5.3 million t (including 35% for processing industry)</td>
</tr>
<tr>
<td></td>
<td>Annual sector turnover: 1.4 billion € including sales of flowers &amp; foliage, nursery plants: 2.5 billion € (direct consumption stage)</td>
<td></td>
<td>Potatoes: 7.0 million t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fruit: 2.7 million t (including 20% for processing industry)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual sector turnover: 16.5 to 18.0 billion € (consumption stage, potatoes excluded)</td>
<td>Processing industry: 144 units</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Annual industrial turnover: 2.9 billion € (consumption stage)</td>
</tr>
<tr>
<td><strong>Activities in the upstream production chain</strong></td>
<td>Plant material propagation: production of seeds (ornamentals &amp; vegetables), cuttings, young plants &amp; transplants, etc.</td>
<td>Fresh plants or plant components (herbs)</td>
<td>Fruit &amp; nuts, bramble fruit</td>
</tr>
<tr>
<td></td>
<td>Flowers, foliage, potted plants &amp; bedding plants, nursery plants (trees &amp; shrubs), bulbs, etc.</td>
<td>Drying or distillation (frequent at production stage)</td>
<td>Vegetables issued from open field or shelters, cultivated mushrooms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other processing operations requiring industrial facilities (e.g. deep-freezing)</td>
<td>Canning, deep-freezing, ready-to-eat (fresh-cut or processed), sugar-preservation, oil extraction, jams &amp; beverages (e.g. juice), fermentation, pickling, etc.</td>
</tr>
<tr>
<td><strong>Second transformation activities</strong></td>
<td>None</td>
<td>Perfume, aromas, nutraceuticals, drugs, food supplements, etc.</td>
<td>Fruit mix, mixed vegetables, agri-food industries</td>
</tr>
<tr>
<td><strong>Other plant use</strong></td>
<td>Landscaping for communities or individuals</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Sale activities</strong></td>
<td>On-farm sales, fairs and city markets, garden-centers, mass retails, florists, online sales</td>
<td>On-farm sales, agri-food industries</td>
<td>On-farm sales, primeurs and city markets, specialized fresh retails, mass retails, online sales</td>
</tr>
<tr>
<td></td>
<td>3,300 (as main activity)</td>
<td>ca. 5,000 (farms)</td>
<td>Private and collective catering</td>
</tr>
<tr>
<td><strong>Production units</strong></td>
<td>15,000 to 16,000 ha (including shelters: 1,600 ha)</td>
<td>53,000 ha</td>
<td>Fruit: 170,000 ha</td>
</tr>
<tr>
<td></td>
<td>18,900 firms including: - 395 wholesalers, - 15,100 florists, - 3,400 garden-centers</td>
<td>Many trade channels, depending on the nature of plant extracts and uses</td>
<td>Vegetables: 220,000 ha (including shelters 7,500 ha)</td>
</tr>
<tr>
<td><strong>Trade/sales</strong></td>
<td>16 billion € (50% finished plants/50% nursery plants)</td>
<td>Shipping &amp; export business: 350 Wholesalers (including central purchasers): 1,168 Primeurs and specialized fresh retails: 11,700 Hyper- &amp; supermarkets: 12,776 Importers: 150</td>
<td></td>
</tr>
<tr>
<td><strong>Landscaping</strong></td>
<td>30,250 firms</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Annual turnover (production stage)</strong></td>
<td>1.6 billion €</td>
<td>0.15 billion €</td>
<td>8.1 billion €</td>
</tr>
<tr>
<td><strong>Evolution</strong></td>
<td>Reduction in the number of farms, reduction in the number of jobs (full time equivalent)</td>
<td>Sharp development: +40% over the last 5 years</td>
<td>Fruit crops overall in decline vs. stability for vegetables</td>
</tr>
<tr>
<td></td>
<td>Significant increase in the organic products segment: +16% of sales in 2017</td>
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</tr>
<tr>
<td></td>
<td>Slow decrease in consumption of fresh and processed vegetables, stability for fruit</td>
<td></td>
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</tr>
<tr>
<td><strong>Offer grouping</strong></td>
<td>ca. 15 producers’ organizations</td>
<td>ca. 15 producers’ organizations</td>
<td>225 producers’ organizations, 300 cooperatives (partial double count)</td>
</tr>
</tbody>
</table>
In the fruit and vegetable sector, innovation tribute to the development of aromatic or plant for essential oils, that can greatly con-

vesting operations, upstream of a distillation for example, with the modernization of har-

future of a crop production. This is the case, also crucial and can greatly influence the

products, innovations in the processing are

portal for food supplements). For processed

monthly applications on the registration

as a rapid turnover is observed (over 1,000

of an end-product can be ephemeral, where-

ant in the HMAP sector, where the market life

This axis of innovation is particularly import-

of these plants are cropped.

Developing innovation

Beyond the technical solutions expected by each commodity chain for the resolution of their cropping problems and the reduction of their production costs, research and inno-

vation largely contribute to the dynamics of the chain concerned. This is particularly the case of “produce innovation,” whether it is about releasing new varieties or increasing the processed value of secondary metabolites (Box 1).

This axis of innovation is particularly important in the HMAP sector, where the market life of an end-product can be ephemeral, whereas a rapid turnover is observed (over 1,000 monthly applications on the registration portal for food supplements). For processed products, innovations in the processing are also crucial and can greatly influence the future of a crop production. This is the case, for example, with the modernization of harvesting operations, upstream of a distillation plant for essential oils, that can greatly contribute to the development of aromatic or medicinal plants.

In the fruit and vegetable sector, innovation is the key driver for the agroecological transition and for securing the quality of the produce (especially food safety of fresh produce to be processed) (Box 2–3). In the sector of processed fruits and vegetables, the Qualiveg-2 technological mixed unit supported by the Technical Center for the Conservation (and processing) of Agricultural Products (CTCPA) and the National Institute for Agricultural Research (INRA) in Avignon, is in charge of developing collaborative projects related to organoleptic, health and nutrition quality of fruit and vegetable produce. Innovation ultimately increases value and contributes to the competitiveness of French industries that are strongly challenged internationally by countries with lower production costs. Organizational innovation is sought as well, such as corporate social responsibility (CSR) implemented downstream in value chain companies generally, which contributes to local or at least national sourcing.

Foresight studies at FranceAgriMer

What would happen if, in 25 years, the fruit tree breeding is controlled by the processing industry? If ornamental plants are only cultivated for their capacities of phytoremediation of polluted soils, storm water management, urban temperature mitigation, etc.? If climate change completely upsets the list of varieties of fruit and vegetables cultivable in France? If the food stores totally disappear? And if …?

Because the long-term future is neither predetermined nor predictable, because it opens many options, and because it never emerges from the void but from the present, which holds heavy tendencies and weak signals as well, foresight studies allow consideration of the room to maneuver that actors have to favor the arrival of a desirable future, or at least chosen in part. These studies make use of a systemic approach that brings into perspective each question raised in relation to different possible constructions of the future world. Since its creation in 2009, FranceAgriMer has coordinated a series of foresight studies within the agricultural and horticultural sectors (Box 4) to jointly build common representations of these sectors and to discern scenarios for the future. Once a foresight study is completed, the actors of the concerned sector are invited to analyze the consequences of the various emerging scenarios. Then, from the subsequent debate on the future, possible scenarios of evolution can emerge, giving rise to a collective strategy for the sector.

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*Metropolitan France, including Corsica, and excluding the French West Indies, French Guyana, La Réunion and Mayotte islands.

## Table: Sales, Production and Inter-branch Organisations

<table>
<thead>
<tr>
<th>Category</th>
<th>Value/Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import</td>
<td>0.9 billion €</td>
</tr>
<tr>
<td>Export (value)</td>
<td>56 million €</td>
</tr>
<tr>
<td>Production staff number</td>
<td>19,300</td>
</tr>
<tr>
<td>Inter-branch organisations</td>
<td>VAL’HOR, CHIEF, INTERFEL, ANIFELT</td>
</tr>
<tr>
<td>Signals of quality (certification or labelling)</td>
<td>Red labels and Blue Plant label, high environmental value (HEV) and milieu programma sierteelt (MPS), Fleurs de France, etc.</td>
</tr>
<tr>
<td>Technical institutes</td>
<td>ASTREDHOR with a network of 10 regional stations</td>
</tr>
<tr>
<td>Public research</td>
<td>INRA centers (Angers, Sophia Antipolis, PACA Avignon) Joint research units with higher education organizations &amp; joint technological units with other partners</td>
</tr>
<tr>
<td>Import 0.9 billion €</td>
<td>2.45 billion € (essential oils)</td>
</tr>
<tr>
<td>Export (value) 56 million €</td>
<td>2.2 billion € (slightly processed), more than 10 billion € (finished products)</td>
</tr>
<tr>
<td>Production staff number</td>
<td>6,000</td>
</tr>
<tr>
<td>Inter-branch organisations</td>
<td>VAL’HOR, CHIEF, INTERFEL, ANIFELT</td>
</tr>
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<td>Signals of quality (certification or labelling)</td>
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<td>Public research</td>
<td>INRA centers (Angers, Clermont-Ferrand, Evry) French higher education organizations in partnership with CRIEP-PAM &amp; ITEIPMAI</td>
</tr>
</tbody>
</table>

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Box 3. Research and development players in the ornamental and nursery chains

- ASTREDHOR, the technical institute of horticulture, was created in 1995. It now includes a national unit and six regional units, grouping ten experimental stations distributed in the different French horticultural production basins. It mobilizes a total of 105 employees (87 full time equivalent) of whom 75% are scientific staff. Its consolidated budget is 6.9 million Euros. Its scientific project is structured for the period 2018-2022 around five major challenges for the sector:
  - development of alternative production systems and accompanying related transitions,
  - development of green engineering and the consideration of ecosystem services provided by plants,
  - emergence of new industrial recovery opportunities for the bioeconomy,
  - adaptation of companies to economic developments and markets,
  - emergence of “connected” horticulture.

ASTREDHOR is involved in different partnership arrangements at the European, national or regional levels.

- ITEIPMAI: applied research and experiments in medicinal and aromatic plants are mainly carried out under the aegis of this national technical institute by a network of four technical structures including ITEIPMAI, the Regional Interprofessional Center for Experimentation in Perfume, Aromatic and Medicinal Plants (CRIEPPAM) specialized in the Mediterranean cultures and their first transformation, the National Repository of Perfume, Medicinal and Aromatic Plants (CNPMAI) ensuring the germplasm conservation, and Agriculture Chamber of the Drôme department. This network brings together about 55 permanent staff for an annual budget of about 4 million Euros. Partnerships with public research centers are established as needed, depending on the nature of the projects. Insofar as these productions are of little interest to plant breeders, phytosanitary firms and manufacturers of agricultural equipment, the field of investigation of these organizations is very broad: genetic improvement, crop protection, weeding, mechanization of crops, first transformations, and technical support.

Box 4. Foresights applied to French horticulture: example of the scenario “Fruit varieties for the future”

At FranceAgriMer, a small team carried out foresight exercises to meet the demands of the agricultural sectors. Based on a method developed in the 90s by Michel Sebillotte at INRA, this team implemented various methodological complements allowing for scale changes (from national to local, from the whole sector to a profession, etc.), and the passage from micro- to macro-scenarios. A dozen exercises have been carried out since 2009 for plant and animal sectors. For horticulture in particular, the studies were as follows: Foresight on fruit & vegetables (October 2009 - October 2011), Foresight on ornamental horticulture (March 2012 - March 2014), Foresight on the cider value chain (March 2014 - January 2016), Foresight on fruit varieties for the future (April 2016 - November 2018), Foresight on the French HMAP sector (in progress from June 2018). A comprehensive report and a synthesis were published from these analyses, as well as the organization of participatory presentations. For example, the foresight on fruit varieties of the future produced four contrasting scenarios:
  - Variety innovation for orchards adapted to climate change,
  - Dynamics in fruit breeding under control for demanding consumers,
  - A slow fruit variety creation for a low price market,
  - Transformers driving variety innovation.

Marie-Agnès Oberti is delegate for the fruit and vegetable sector, Claude Chailan is delegate for the special plants production sector, Françoise Brugière is heading the mission of foresight studies. The authors are part of FranceAgriMer (www.franceagrimer.fr), French office for agricultural and marine products, an establishment whose mission is to apply in France some of the measures falling under the Common Agricultural Policy of the European Union, and to carry out national actions in favor of French agricultural sectors. E-mail: marie-agnes.oberti@franceagrimer.fr, claude.chailan@franceagrimer.fr, francoise.brugiere@franceagrimer.fr