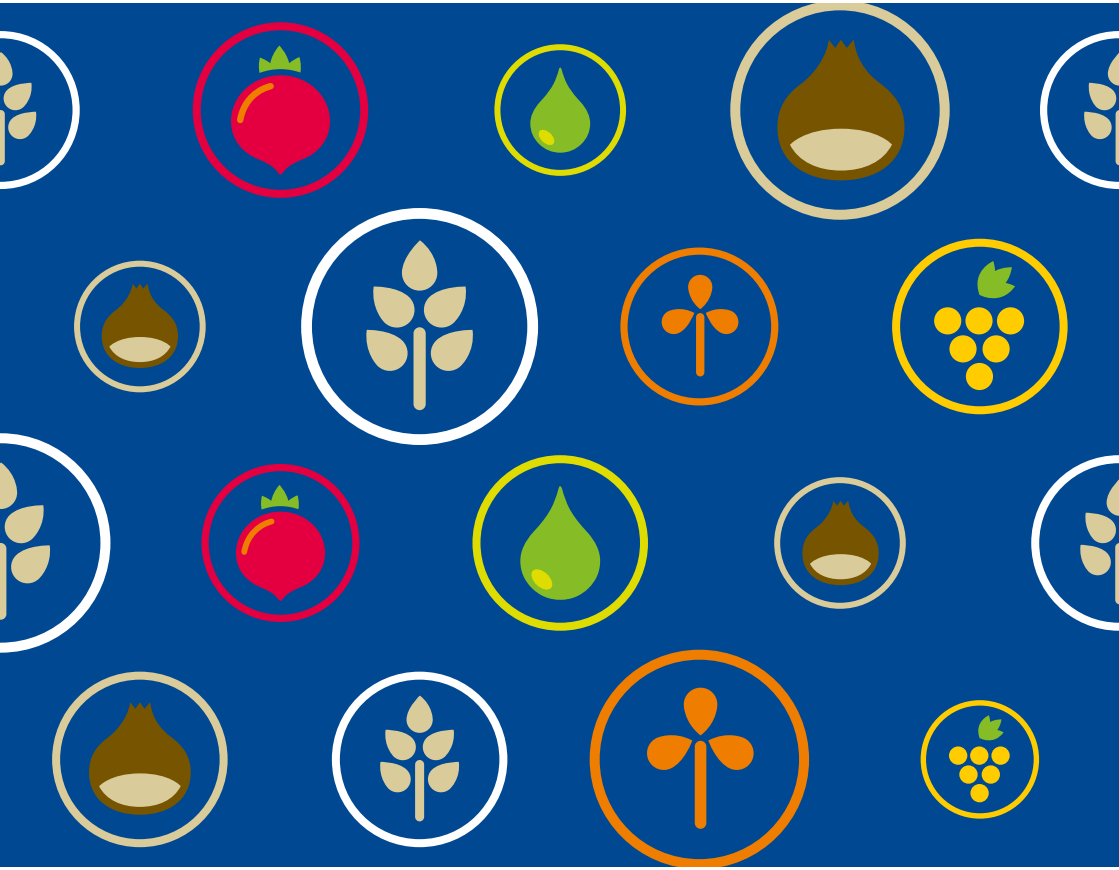
ENHANCEMENT AND PECULIARITIES OF **AGROFOOD PRODUCTS** FOR LOCAL DEVELOPMENT



AGROFOOD GUIDE
ACADEMIC YEAR 2019 / 2020

UNIVERSITÀ DEGLI STUDI DELLA Tuscia

UNITUS
ENHANCEMENT
AND PECULIARITIES
OF AGROFOOD PRODUCTS
FOR LOCAL DEVELOPMENT

Agrofood Guide
Academic Year 2019 / 2020

UNIVERSITÀ
DEGLI STUDI DELLA
Tuscia

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INTRODUCTION

The agrofood sector includes all the activities related to the production, the transformation, the distribution and the marketing of food products. It has to do with agriculture, the agrofood sector as well as wholesale and retail trade. The current features of the Italian agrofood system are mostly the result of the primary sector's development process and the gradual development of inter-sector dynamics. These dynamics have involved a growing number of people who work in different types of activities. The result is a complex interaction of different trade sectors which today constitute the whole agrofood system[1].

During the globalisation process, sometimes more specialised farms only guarantee the vegetable and animal production, while all the non-agricultural activities are transferred to the industrial, commercial or craft sectors. The agriculture sector purchases more and more industrial products (fertilisers, plant health products, agricultural machinery and equipment) to improve its productivity and intensity production. In exchange, it provides increasing quantities of raw materials to the processing industry and products to commercial industries operating between the agricultural sector and consumers. The food function is not an exclusive of the agricultural sector anymore, as several production and distribution units dominate the agro-food industry. Agriculture is but a single component of this system. At the same time, agriculture and food are becoming more international and, with the new exchange relationships, agriculture is becoming more and more financially and technologically dependent from its partners as well as more and more sensitive to international influences. Currently, food undergoes a huge number of technical and commercial operations before it lands on the consumer's table[2]. Figure 1 illustrates the phases and actors of the agro-food system.

1 Unioncamere report (2013). Sector analysis: The agrofood industry in the Lazio region. Observatory for the internationalisation of Lazio, December 2013, Rome

2 Chapter II, The food supply.

The 2013 Unioncamere report states that the Italian agro-food sector is partly characterised by small and micro companies which are often familiy-run. The fact that such companies are small in size means that they are often not very competitive against the large national and international companies working in the mass market, which is dominated by organised distribution. However, this weakness is partially offset by their flexibility in terms of organisation and inclination to process and product innovation, which means they occupy the international and national niches of medium-high level consumers who are looking for quality food. Let us think of the typical productions of the 'Made in Italy' tradition, which differentiate Italy from its foreign competitors and guarantee a privileged access to the internal and international markets[3]. The small-craft characteristics and resorting to tradition in the production process are two peculiar characteristics of the Italian agro-food sector, followed by the geographic differentiation in the whole country[4]. In 2014, the number of agricultural companies was 1.620.884, of which 829.134 were registered with a VAT number[5].

The Italian food industry is the second largest sector after the mechanical engineering sector. Confindustria data[6] show that 2013 was the worst year for the Italian food industry, with a 132 billion Euro turnover, 385 thousand people employed and 6,900 companies with more than 9 employees. This happened because food sale went down by 4% (domestic turnover at constant values) and by 2.1% in terms of quantity. Regardless of this, the food sector was the one that best reacted to the general crisis. The 2013 report on the state of agriculture[7] shows that exports were the main source of income of the agro-food sector. However, differently from 2012, imports were also on the up, which shows an improved international system integration. European consumers show more interest towards the quality of Italian agro-food products. In order to allow people working in this sector to exploit their products' added value to the full, the European Union has introduced a few specific certifications for the geographic origin of foods (DOP and IGP), with the guaranteed traditional specialities (STG) and with the adoption of CE regulation n. 834/2007 related to organic production and the labelling of organic products. Istat[8] says that, except for the wine sector, Italian agro-food specialities with such labels which are recognised and protected by the European Union were 261 on 31st December 2013. This is the highest number of certifications at a European level, which confirms the growing importance of the Italian quality agro-food production. The most important

3 Fondartigianato (2011). Agribusiness sector training plan. Lazio Region, Rome
4 Carbone A., De Benedictis M., (2003). Processes of transformation and competitiveness of the Italian agri-food system in a more Europe great. Journal of Italian Economics, No. 1
5 Nimismea Report (2014). The Italian Agribusiness Supply Chain: Value and Food Price Formation along the Supply Chain, developed by Nomisma for ADM, the Association of Modern Distribution, Milan
6 Confindustria report (2014). The food industry - analysis of the situation, Confindustria study office, Udine.
7 Inea report (2014). Report on the state of agriculture, Inea and Ministry for the agricultural and forestry policies (www.inea.it)
8 http://noi-italia.istat.it/

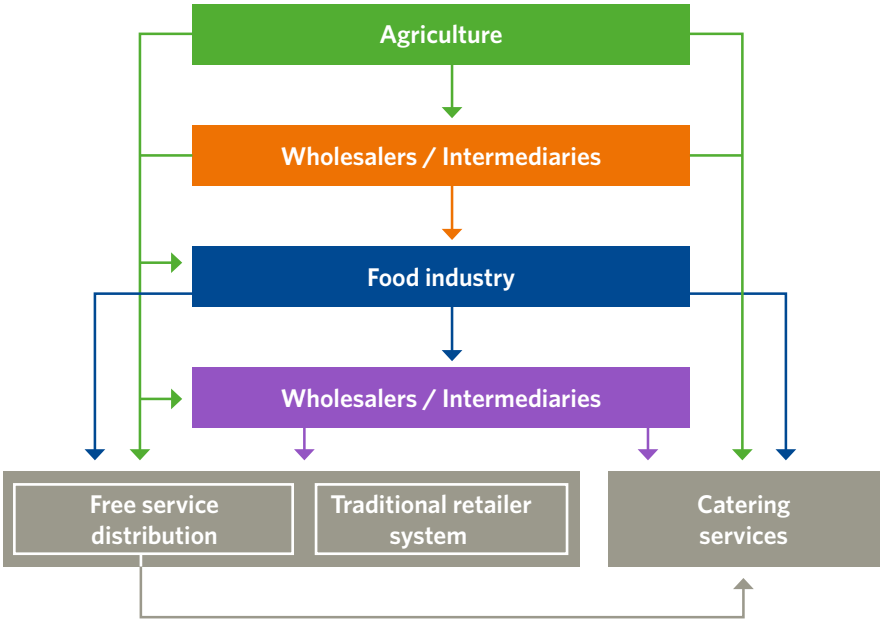

Figure 1 Phases and actors of the agrofood chain *(source: Unioncamere report (2013).*

Italian agro-food sectors in 2013 were fruit, vegetables and cereal (101 products, mostly labelled as IGP), cheese (47 products, nearly all of them labelled as DOP), extra-virgin olive oil (43 products, almost all of them labelled as DOP) and meat preparations (37 products of which more than a third are labelled IGP; the remainder have a DOP label). Italy boasts a total of 80,400 producers and 'processors' working in the agro-food industry who work on about 400 acres of land and manage about 42,000 farms. As for organic food, SINAB data of 31st December 2013 says that there were 52,383 operators (+5,4% compared to 2012) and an agricultural area of over 3250 acres of land (+12,8 compared to 2012). Within this context, in 2012 the Lazio region was the best region in Central Italy in terms of cost competitiveness (112,2[9]). As for quality certifications, there were 2,345 producers of goods with DOP and IGP certifications[10], which sets the Lazio region at the 11th place in the national ranking. As for organic food production, the Lazio region is the 6th region of Italy both for the number of operators and for the amount of land cultivated. In 2012, Italy had 59,000 food companies of which 3,646 were in the Lazio region (this is 6,1% of the total), which set the Lazio region at the 8th place at a national level[11].

9 Values for 100 Euros of unit labour cost, Istat data, 2012
10 Number of producers of DOP and IGP products on 31st December 2013, Istat data
11 Unioncamere Report (2013). Sector analysis: The agri-food industry in Lazio. Observatory on the internationalization of the Lazio, December 2013, Rome

As for the province of Viterbo, the agro-food sector is the most important one, both in terms of number of companies and employees. The 2013 data shows that 31,2% of companies in the Tuscia region work in the agro-food sector, which caters for 14,8% of jobs in the province of Viterbo. Agriculture and the agro-food industry are fundamental sectors for the local area. This is also due to the fact that several agricultural products have been rewarded with quality certifications (DOP for the Canino oil and Tonda Gentile Romana, just to mention two of them). This sector's importance also influences our university, as the connection between agriculture and the agro-food sector and our university is very strong and mutually supportive. Our joint aim is that of improving the agricultural production by making it more competitive through strategies based on innovation and quality. This is even more important because in the Lazio region, the University of Tuscia is the only one boasting specific departments for this sector. The University of Tuscia interacts with the agricultural and agro-food sector on more than one level. For example:

- **Didactic activity**
- **Research**
- **Relationships with business representatives**

DIDACTIC ACTIVITY

The didactic activity is very important, as it can provide young people with the knowledge and the competences to spend in the agro-food sector. Therefore, didactics is an essential phase for training the students who will be working in this sector. The university of Tuscia has a comprehensive training offer going from the study of the primary supply chain to the agro-good transformation.

There are two main departments operating within the agriculture and agro-food sectors:

- DAFNE Department of Agricultural and Forestry Sciences
- DIBAF Department for the innovation in biological, agro-food and forestry systems

DAFNE is the only university department of the Lazio region that is devoted to agricultural and environmental sciences, the conservation of forests and nature and the agricultural biotechnological sector. The department's didactic activity is closely linked to research, which reaches very high levels of excellence in the scientific areas involved.
In 2017, DAFNE obtained the highest number of points in a preliminary ranking by the Italian Ministry of Education that includes 352 Italian university departments of excellence. In 2018, DAFNE was included in a final ranking of 180 Italian university departments of excellence and it will receive funding for a five-year project aimed at further improving the quality of teaching and research. The project title is: "Sustainability of agriculture and forestry in the Mediterranean in the context of global change".
The importance of this result is further confirmed by the national situation. DAFNE is one of the ten departments that received an award for the Area "07 - Environmental and Veterinary Sciences", within which it is one of the five departments in the agricultural sciences sector.

DIBAF is the only university department of the Lazio region devoted to Food technology and oenology and scientific and technological innovation in the promotion, protection and management of biological systems and forestry resources, agro-food transformation and safety, the chemistry of the environment and of the local areas, with a focus on environmental sustainability.
Both departments boast a close connection between teaching and research. This connection is more and more evident as one goes from the three-year degree courses and the second level degree courses to the PhD and research programmes.

DAFNE

Of the six degree courses offered (three three-year degree courses - LT and three second-level degree courses - LM), three concern the agro-food sector. Of these, one is a three-year degree course and two of them are second-level degree courses. These are the second-level degree course in Agricultural and Environmental Sciences and the second-level degree course in Biotechnology for Agriculture, Environment and Health.

WeDAFNE

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Degree in AGRICULTURAL AND ENVIRONMENTAL SCIENCES

The three-year degree course in **Agricultural and environmental sciences (SAA)** offers transferable knowledge and skills in various aspects of agricultural and environmental sciences, such as: production and protection of agriculture; breeding of the main zootechnical species; the first transformations of agro-zootechnica produce; agricultural economics and politics in related agricultural sectors; rural valuations and the commercialization of agricultural produce; main technologies for the production chain. At the same time, the course deals with sustainability and environmental protection which currently characterise the sector of agriculture. Moreover, it trains students to work as junior agronomers, as per DPR 328/2001. The set of knowledge that can be acquired provides a systemic perspective on agricultural and zootechnical production. The structure of the degree course is organised along two curricula: Agricultural and Environmental Sciences and Agricultural Biotechnology. These offer students the opportunity to focus on very specific themes in the field of Agricultural Sciences. In particular, the programme Agricultural and Environmental Sciences includes three core modules: Agriculture & Environment, Zootechnical and a new Quality Control Certification of Produce and Agricultural Processes module. The specific subjects related to each of the above-mentioned profiles focus on the most current topics related to agriculture. These are crucially important to keep this sector competitive. The Agricultural and Environmental Sciences three-year degree course provides basic training with specialised in-depth study through the

study plan as well as an intense practical and lab programme, visits to specialised companies, workshops and training programmes. This multidisciplinary approach will allow students to continue their studies with specialised degree programmes. Furthermore, it equips students with the skills to operate directly in the sector of agriculture or similar areas, with the capacity to interact with a diverse range of professionals. The programme Agricultural Biotechnology teaches the basic principles of agricultural, plant and animal biotechnology and enables students to interact critically in the issues related to biotechnological applications in the field of agriculture. In addition to supplying the specific academic requirements to attain the MSc LM7, the programme equips students with the basic practical skills for agricultural biotechnology. The specific training objectives of the Agricultural and Environmental Sciences degree are the knowledge of the core subjects and their practical elements, the acquisition of competences related to the management of plant and animal production, propagation, reproduction, farms or systems planning, agroeconomic or animal husbandry management, plant health protection and the transformation of products. All of the above is complemented by specific knowledge and competences related to the technical-financial management of companies and food marketing. The specific aim of the biotechnological programme is to equip students with the basic skills in order to understand the agricultural biotechnological sector. The Department collaborates with a vast network of qualified businesses which operate in the most wide-ranging sectors of agriculture, which offer students the possibility to experience practical aspects of their training and working methods in the various sectors. This is a gradual process, which introduces the student to the realities of production processes during their mandatory period of traineeship or the writing of their final paper.

The three-year study programme enables the student to develop the skills to appraise and critically analyse problems and to formulate solutions.

AGRICULTURAL AND ENVIRONMENTAL SCIENCES

EXAM	Professor	SSD	Year	Sem.	CFUs
Agricultural botanics	Luca Santi	BIO/03	I	I	**8**
Organic chemistry and elements of general chemistry	Roberta Bernini	CHIM/06	I	I	**8**
Mathematics and elements of physics *	*	MAT/05	I	I	**8**
English language	*	L-LIN/12	I	I	**6**
Biology and domestic animals breeding:					
- Special zootechnology: technologies for animal breeding	Nicola Lacetera	AGR/19	I	II	**6**
- Animal biology and general zootechnology	Patrizia Morera	AGR/19	I	II	**6**
Physiology and principles of plant biotechnologies	Daniel Savatin	BIO/04	I	II	**6**
Agricultural economy fundamentals	Saverio Senni	AGR/01	I	II	**6**
Agricultural genetics	Carla Ceoloni	AGR/07	I	II	**6**
Agronomy	Raffaele Casa	AGR/02	II	I	**7**
Horticulture and floriculture	Giuseppe Colla	AGR/04	II	I	**6**
Hydraulics and mechanics for agriculture					
- Water engineering	Andrea Petroselli	AGR/08	II	I	**6**
- Mechanics for agriculture	Danilo Monarca	AGR/09	II	I	**6**
Tree crops	Rosario Muleo	AGR/03	II	II	**6**
Grass crops	Enio Campiglia	AGR/02	II	II	**6**
Rural buildings and topography	Alvaro Marucci	AGR/10	II	II	**8**
Farm economy	Gabriele Dono	AGR/01	III	I	**6**
Agrarian industries	Katia Liburdi	AGR/15	III	I	**6**
Crop protection:					
- Agrarian entomology	Adalgisa Guglielmino	AGR/11	III	I	**6**
- Plant pathology	Leonardo Varvaro	AGR/12	III	II	**6**
Agricultural evaluation	Attilio Coletta	AGR/01	III	II	**6**

EXAM	Professor	SSD	Year	Sem.	CFUs
ENVIRONMENTAL AGRARIAN PROFILE					
Soil chemistry	Stefania Astolfi	AGR/13	II	I	**6**
Agrarian ecology	Roberto Mancinelli	AGR/02	II	II	**6**
Energy and environment workshop	Maurizio Carlini	ING-IND/09	III	I	**3**
LIVESTOCK PROFILE					
Animal well being and health and livestock environmental impact	Nicola Lacetera	AGR/19	II	I	**6**
Livestock nutrition	Umberto Bernabucci	AGR/18	II	II	**6**
Energy and environment workshop	Maurizio Carlini	ING-IND/09	III	I	**3**
TERRITORY, ENVIRONMENT AND LANDSCAPE PROFILE					
Regional planning	Antonio Leone	ICAR/20	II	I	**6**
Landscape architecture workshop	*	ICAR/15	II	II	**6**
GIS workshop	Fabio Recanatesi	AGR/10	III	II	**3**
PRODUCT QUALITY AND AGRICULTURAL PROCESS CERTIFICATION PROFILE					
Process and plant production quality and certification	Enio Campiglia	AGR/02	II	I	**6**
Process and animal production quality and certification	Umberto Bernabucci	AGR/18	II	II	**6**
Energy and environment workshop	Maurizio Carlini	ING-IND/09	III	I	**3**
Training activities chosen by the student			I		**12**
Training			II		**13**
Final test			III		**5**

AGRICULTURAL BIOTECHNOLOGY

EXAM	Professor	SSD	Year	Sem.	CFUs
Agricultural botanics	Luca Santi	BIO/03	I	I	**8**
Organic chemistry and elements of general chemistry	Roberta Bernini	CHIM/06	I	I	**8**
Mathematics and physics fundamentals	*	MAT/05	I	I	**8**
English language	*	L-LIN/12	I	I	**6**
Biology and domestic animals breeding:					
- Special zootechnology: technologies for animal breeding	Nicola Lacetera	AGRA/19	I	II	**6**
- Animal biology and general zootechnology	Patrizia Morera	AGR/19	I	II	**6**
Physiology and principles of plant biotechnologies	Daniel Savatin	BIO/04	I	II	**6**
Agricultural economy fundamentals	Saverio Senni	AGR/01	I	II	**6**
Agricultural genetics	Carla Ceoloni	AGR/07	I	II	**6**
Agronomy	Raffaele Casa	AGR/02	II	I	**7**
Plant production biotechnologies:					
- Genetic biotechnologies	Stefania Masci	AGR/07	II	I	**6**
- Biotechnologies for the improvement of agrarian plants	Andrea Mazzucato	AGR/07	II	I	**6**
Horticulture and floriculture	Giuseppe Colla	AGR/04	II	I	**6**
In vitro culture science and technique	Cristian Silvestri	AGR/03	II	I	**6**
Tree crops	Rosario Muleo	AGR/03	II	II	**6**
Grass crops	Enio Campiglia	AGR/02	II	II	**6**
Rural buildings and topography	Alvaro Marucci	AGR/10	II	II	**8**
Animal biotechnologies	Loredana Basiricò	AGR18	III	I	**6**
Agrarian industries	Marco Esti	AGR/15	III	I	**6**
Energy and environment workshop	Maurizio Carlini	ING-IND/09	III	I	**3**
Crop protection					
- Agrarian entomology	Adalgisa Guglielmino	AGR/11	III	I	**6**
- Agrarian pathology	Leonardo Varvaro	AGR/12	III	II	**6**
Molecular biology of agrarian plants	Francesco Sestili	AGR/07	III	II	**6**
Agricultural evaluation	Attilio Coletta	AGR/01	III	II	**6**
Training activities chosen by the student			I		**12**
Training			II		**13**
Final test			III		**5**

BIOTECHNOLOGY FOR AGRICULTURE, THE ENVIRONMENT AND HEALTH

Educational goals

The second cycle degree course in Biotechnology for Agriculture, the Environment and Health (CdLM/BioSiQuAl) is aimed at giving graduates a deep knowledge of the scientific aspects related to biotechnology for the development and improvement of agricultural authorities. Students will learn about the quality and safety control of raw materials and agro-food products, how to improve their nutritional and health value through the study of natural organic substances included in food and agro-industrial waste, and how to use them as ingredients in neutraceutical and pharmaceutical preparations. The CdLM/BioSiQuAl course offers extremely specialised training. Graduates will have the knowledge and skills needed to analyse different biological and agro-food systems to understand, design and develop solutions to the issues related to animal and crop production in a rational, innovative and sustainable way. The demand for natural organic substances and bioactive molecules to replace synthetic products through biotechnologies and extraction processes deriving from agro-industrial waste moves production towards a type of agriculture that provides products for industrial use that are connected to green chemistry and to the agro-industrial, manufacturing and energy sectors. All the courses are completed by a series of practical workshops in laboratories and on the field. The CdLM/BioSiQuAl course includes several scientific cooperation agreements/conventions with other research authorities and businesses operating in agro-biotechnology, the neutracetical and pharmaceutical sectors. This gives

students research opportunities and it exposes them to the world of production thanks to educational visits, training courses and 'external' dissertations. The course includes 11 exams and 12 CFUs from vocational training chosen by the student, 6 for English, 4 for training and 23 for the final dissertation.

Career opportunities

Graduates will find work in state-run and private organisations or work as self-employed professionals and entrepreneurs.

There are many job opportunities for these graduates:

- researcher, technician and similar in state-run and private research organisations dealing with innovative, quality and low-environmental impact products and with the characterisation of bioactive molecules;
- regional associations aimed at developing and innovating agriculture and the environment (decontamination, environment conservation and improvement);
- national and international food safety agencies;
- seed companies dealing with the selection and certification of plant varieties;
- pharmaceutical and neutraceutical production and distribution companies;
- companies dealing with the certification of primary production;
- national and international breeders for the management of genetic improvement;
- International cooperation for technological development and the improvement and conservation of the environment;
- observers, public and private agencies for the control of plant health and the protection of plants;
- armed forces, Carabinieri scientific investigation teams and specialised departments of the Italian Navy for technical-scientific support;

the ISTAT employment rate for second degree course graduates after one and three years from the degree equals 75% and 79% respectively (ALMALAUREA 2017).

EXAM	Professor	SSD	Year	Sem.	CFUs
Plant species genomics and biotechnological applications:					
- Plant species genomics	Carla Ceoloni	AGR/07	I	I	**6**
- Biotechnological applications and bioinformatics	Francesco Sestili	AGR/07	I	I	**6**
Traditional and innovative food biotechnologies	Marco Esti	AGR/01	I	I	**7**
Biotechnologies and animal production nutraceutical	Umberto Bernabucci	AGR/18	I	I	**6**
Genetic improvement and seed biotechnologies	Andrea Mazzucato	AGR/07	I	II	**6**
Chemistry of natural organic substances	Roberta Bernini	AGR/15	I	II	**6**
Plant biotechnologies and pharmaceutical products	Luca Santi	BIO/15	I	II	**6**
English language	*	L-LIN/12	I	II	**6**
Biotechnologies and fruit plants nutraceutical	Rosario Muleo	AGR/03	II	I	**6**
Quality and traceability of animal-based products	Pierpaolo Danieli	AGR/18	II	I	**7**
Quality and traceability of plante-based products	Stefania Masci	AGR/07	II	II	**7**
Bio-Economy	Simone Severini	AGR/01	II	II	**7**
One of the following three optional exams:					
Soil fertility and plant nutrition	Stefania Astolfi	AGR/13	II	I	**6**
Biotechnologies for stress control	Daniel Savatin	BIO/04	II	I	**6**
Phytopathological agro-industrial biotechnologies	G. M. Balestra	AGR/12	II	I	**6**
Training activities chosen by the student			I/II		**12**
Training			I/II		**4**
Thesis			II		**23**

Second-level degree course in AGRICULTURAL AND ENVIRONMENTAL SCIENCES

The second-level degree course in **Agricultural and environmental Sciences** provides in-depth and specialised knowledge and competences related to plant and livestock production, aimed at planning and managing innovation in agricultural production from a quality and quantity point of view, which a systemic approach. The degree course contributes to the acquisition of specific knowledge and competences in plant and animal production, innovative land use, environmental sustainability, the safety of food and of the people who work in this sector. Graduates will acquire an in-depth understanding of the processes, rules and regulations related to the application of financial techniques in order to face the issues related to agricultural companies and rural development management.

The shared core subjects deal with the topics of research methodology in agriculture, management of agricultural and zootechnical systems, and sustainable resource strategies in crop protection, agricultural policies, farm management and investments analysis, innovative agricultural machinery and land use.

- The **Cultural Module** focusses on the higher quality of crop production, the genetic improvement of crops, the production of fruit and vegetables, and viticulture;

- The **Land and Economics Module** focusses on the optimization of land use, job security in agriculture, and the economics and policies of rural development;

- The **Zootechnology Module** focuses on: optimization and conservation of fodder, acquisition of expertise in the science and technology of nutrition in zootechnical systems, and on the quality of animal-derived products.

EXAM	Professor	SSD	Year	Sem.	CFUs
Microbiology applied to cultivation systems	Elena Di Mattia	AGR/16	I	I	**6**
Landscape structure and agricultural mechanisation:					
- Landscape structure	Maria Nicolina Ripa	AGR/10	I	I	**8**
- Agricultural mechanisation	Danilo Monarca	AGR/09	I	I	**6**
Cultivation systems	Francesco Rossini	AGR/02	I	II	**6**
Tree cultivation for the quality of productions	Rosario Muleo	AGR/03	I	II	**6**
Sustainable strategies in the protection of agricultural cultivation:					
- Agricultural entomology strategies	Stefano Speranza	AGR/11	I	II	**6**
- Plant pathology strategies	Giorgio Balestra	AGR/12	I	II	**6**
Agricultural policies and management of agricultural enterprises:					
- Agricultural policies and market evolution	Simone Severini	AGR/01	II	I	**6**
- Management of agricultural enterprises and investment analysis	Gabriele Dono	AGR/01	II	I	**6**
Research methodologies in agriculture	Raffaele Casa	AGR/02	II	I	**6**
Zootechnology systems	Bruno Ronchi	AGR/18	II	II	**6**
CULTIVATION PROFILE					
Horticultural cultivation in a protected environment	Giuseppe Colla	AGR/04	II	I	**6**
Viticulture	Massimo Muganu	AGR/03	II	II	**6**
Genetic improvement of cultivated plant species	Andrea Mazzucato	AGR/07	II	II	**6**
LANDSCAPE ECONOMIC PROFILE					
Rural landscape planning	Fabio Recanatesi	AGR/10	II	I	**6**
Rural development economy and policies	Saverio Sennni	AGR/01	II	II	**6**
Job safety in agriculture	Massimo Cecchini	AGR/09	II	II	**6**
LIVESTOCK PROFILE					
Quality and security of animal-based products	Pier Paolo Danieli	AGR/18	II	I	**6**
Forage cultivation	Roberto Mancinelli	AGR/02	II	II	**6**
Food science and techniques in zootechnical systems	Umberto Bernabucci	AGR/18	II	II	**6**
Training activities chosen by the student			I/II		**12**
Training			I/II		**2**
Thesis			II		**20**

CROP PRODUCTION AND ANIMAL SCIENCE PHD

The agro-food sector training programme also offers a PhD in ***Crop production and animal science***, which aims at training all-round researchers who are able to work in planning research and carrying it out, as well as interpreting and presenting its results. Students will be helped so that they can choose specific and stimulating courses and carry out study and research activities in national and international organisations. The specific scientific training is aimed at different aspects of agricultural production through the use of traditional, innovative and interdisciplinary methods. The specific research themes of the PhD course are related to precision agriculture and remote sensing, nutrition, livestock nutrition and the related applied biotechnologies, genetic improvement, biotechnologies needed for the understanding of productive and biological aspects, the use of nanomaterials in agriculture, the development of bioactive molecule synthesis and the extraction of organic substances, the making and use of biosensors for environmental monitoring and in the production supply chain, plant protection, the agricultural environment - production mutual influence, land and landscape planning, soil sciences, the technological and nutritional quality of plant-based and animal-based products, food and production safety.

DIBAF

Of the nine degree courses offered (four three-year degree courses - LT and four second-level degree courses - LM, as well as a five-year single-cycle second-level degree course), DIBAF boasts a degree course and a second-level degree course focussed on gastronomic sciences, food technology and wine production, with a specific focus on safety, quality, innovation and sustainability in the agro-food sector.

FOOD TECHNOLOGY AND OENOLOGY

The aim of the undergraduate programme in **Food Technology and Oenology** is to provide a strong interdisciplinary background in the food, wine and wine-making sectors, as well as training professionals and technicians who have appropriate skills to work independently at all stages of the supply chain, from production to consumption of the food and wine products, including the ability to ensure the health and hygiene safety and quality of products, as well as their storage and distribution. That is, providing competences which allow graduates to work in the food industry, which is an extremely multidisciplinary and dynamic sector. The course aims at creating professionals who can innovatively and effectively work in food and wine production and consumption and who also know the main analytical methodologies needed to evaluate the composition, quality and safety of food and beverages. The degree course offers two different curricula:

- Curriculum *Food industry* — *technological profile*, *gastronomic profile*
- *Viticulture and oenology (oenological)*

The **Viticulture and oenology curriculum** is the only course at the University of Tuscia which, under law n. 129 of the 10th of April 1991 and its subsequent amendments, allows graduates to obtain the official qualification of Oenologists.

The **gastronomic curriculum** offers a study pathway carried out by the Università degli studi della Tuscia and the Etoile Culinary Campus Srl, the organisation accredited by the Lazio region. Students will choose the degree course in Food technology and oenology and the new three-year degree course in "Applied food sciences: professional chefs" organised by the Etoile Culinary Campus Srl. This will allow them to obtain a degree and the qualification of "Expert in meal production".

FOOD INDUSTRIES (TECHNOLOGICAL)

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Mathematics	MAT/05	I	I	48	48	0	S/A	**6**
Chemistry				88	80	8	A	**11**
- mod. General chemistry	CHIM/03	I	I	40	40	0		**5**
- mod. Chemistry of organic compounds related to the food industry	CHIM/06 AGR/13	I	II	48	48	0		**6**
Physics	FIS/07	I	I	48	48	0	S	**6**
Biology and general microbiology				96			A	**12**
- mod. General biology	BIO/05	I	I	48	40	8		**6**
- mod. General and aenological microbiology	AGR/16	I	I	48	40	8		**6**
Food technologies of unit operations	AGR/15	I	II	64	64	0	S	**8**
Genetics of vines and plants related to the food industry	AGR/07	I	II	48	48	0	S	**6**
European food law	IUS/03	I	II	48	48	0	S	**6**
Further language knowledge (English B1/English B2)		I	II	40	40	0	S	**5**
Food biochemistry	BIO/10	II	I	48	48	0	S	**6**
Food microbiology	AGR/16	II	I	48				**6**
Food technologies				96	96	0	A	**12**
- mod. Oil production, dairy and other animal-based product technology processes	AGR/15	II	I	48	48	0		**6**
- mod. Quality and certification in food production	AGR/15	II	I	48	48	0		**6**
Quality of tree and trees and vegetable production				96	96	0	A	**12**
- mod. Tree production	AGR/03	II	I	48	48	0		**6**
- mod. Vegetable production	AGR/04	II	I	48	48	0		**6**
Defense of foodstuffs	AGR/12	II	II	48	48	0	S	**6**
Principles of agro-food and wine production economy	AGR/01	II	II	64	64	0	S	**8**
Molecular transformations and fermented food				80	72	8	A	**10**
- mod. Food prepared through fermentation	CHIM/11	III	I	48	44	4		**6**
- mod. Molecular transformations in food	CHIM/11	III	I	32	28	4		**4**
Food conservation, conditioning and distribution	AGR/15	III	I	48	48	0	S	**6**
Food science	MED/49	III	II	48	48	0	S	**6**
Similar and integrated exams				96				**12**

[...]

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Chosen by the student		III						**12**
Useful knowledge to enter the job market								**9**
		I		25				**1**
		II		100				**4**
		III		100				**4**
Training in companies Technological profile		III		225				**9**
For the final thesis		III		150				**6**

FOOD INDUSTRIES (GASTRONOMIC)

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Mathematics	MAT/05	I	I	48	48	0	S/A	**6**
Chemistry				88			A	**11**
- mod. General and inorganic chemistry	CHIM/03	I	I	40	40	0		**5**
- mod. Chemistry of organic compounds related to the food industry	CHIM/06 AGR/13	I	II	48	48	0		**6**
Physics	FIS/07	I	I	48	48	0	S	**6**
Biology and general microbiology				96			A	**12**
- mod. General biology	BIO/05	I	I	48	40	8		**6**
- mod. General and aenological microbiology	AGR/16	I	I	48	40	8		**6**
Food technologies of unit operations	AGR/15	I	II	64	64	0	S	**8**
Genetics of vines and plants related to the food industry	AGR/07	I	II	48	48	0	S	**6**
European food law	IUS/03	I	II	48	48	0	S	**6**
Further language knowledge (English B1/English B2		I	II	40	40	0	S	**5**
Food biochemistry	BIO/10	II	I	48	48	0	S	**6**
Food microbiology	AGR/16	II	I	48				**6**
Food technologies				96			A	**12**
- module 1	AGR/15	II	I	48	48	0		**6**
- module 2	AGR/15	II	I	48	48	0		**6**
Quality of tree and trees and vegetable production				96			A	**12**
- mod. Tree production	AGR/03	II	I	48	48	0		**6**
- mod. Vegetable production	AGR/04	II	I	48	48	0		**6**

[...]

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Defence of food	AGR/12	II	II	48	48	0		**6**
Principles of agro-food and wine economy	AGR/01	II	II	64	64	0		**8**
Food history, culture and languages	L-FIL-LET/14	III	I	48	48	0		**6**
Molecular transformations and fermented food	CHIM/11	III	I	80	72	8		**10**
Food conservation, conditioning and distribution	AGR/15	III	I	48	48	0		**6**
Food science	MED/49	III	II	48	48	0		**6**
Gastronomic technologies and logistics of catering	AGR/09	III	II	48	40	8		**6**
Chosen by the student		III						**12**
Useful knowledge to enter the job market								**9**
		I		25				**1**
		II		100				**4**
		III		100				**4**
Training in companies Technological profile		III		225				**9**
For the final thesis		III		150				**6**

VITICULTURE AND OENOLOGY (OENOLOGICAL)

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Mathematics	MAT/05	I	I	48	48	0	S/A	**6**
Chemistry				88			A	**11**
- mod. General and inorganic chemistry	CHIM/03	I	I	40	40	0		**5**
- mod. Chemistry of organic compounds related to the food industry	CHIM/06 AGR/13	I	II	48	48	0		**6**
Physics	FIS/07	I	I	48	48	0	S	**6**
Biology and general microbiology				96			A	**12**
- mod. General biology	BIO/05	I	I	48	40	8		**6**
- mod. General and aenological microbiology	AGR/16	I	I	48	40	8		**6**
Principles of food technologies of unit operations	AGR/15	I	II	48	48	0	S	**6**
Genetics of vines and plants related to the food industry	AGR/07	I	II	48	48	0	S	**6**
European food law	IUS/03	I	II	48	48	0	S	**6**

[...]

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Further language knowledge (English B1/English B2)		I	II	40	40	0	S	**5**
Food biochemistry	BIO/10	II	I	48	48	0	S	**6**
Food microbiology	AGR/16	II	I	48	48	0	S	**6**
Oenology 1	AGR/15	II	I	64	64	0	S	**8**
Viticulture 1	AGR/03	II	I	64	64	0	S	**8**
Defence of vines				96			A	**12**
- Entomology	AGR/11	II	II	48	48	0		**6**
- Pathology	AGR/12	II	II	48	48	0		**6**
Principles of agro-food and wine economy	AGR/01	II	II	64	64	0		**8**
Exam chosen by the student (second year)		II	II					**12**
Principles of chemistry and fermentation biotechnologies	CHIM/11	III	I	48	48	0	S	**6**
Oenology 2	AGR/15	III	I	64	64	0	S	**8**
Machinery for the food and wine industry	AGR/09	III	II	48	48	0	S	**6**
Exam chosen by the student (third year)		III						**6**
Chosen by the student		III						**12**
Useful knowledge to enter the job market								**9**
		I		25				**1**
		II		100				**4**
		III		100				**4**
Training in companies Oenological profile								**9**
		II						**4**
		III						**5**
For the final thesis		III		150				**6**

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Exam chosen by the student (second year)		II	II					**12**
Principles of chemistry and fermentation biotechnologies	CHIM/11	III	I	48	48	0	S	**6**
Oenology 2	AGR/15	III	I	64	64	0	S	**8**
Machinery for the food and wine industry	AGR/09	III	II	48	48	0	S	**6**
Exam chosen by the student (third year)		III						**6**
Chosen by the student		III						**12**
Useful knowledge to enter the job market								**9**
		I		25				**1**
		II		100				**4**
		III		100				**4**
Training in companies Oenological profile								**9**
		II						**4**
		III						**5**
For the final thesis		III		150				**6**

SIMILAR AND INTEGRATED EXAMS (TECHNOLOGICAL AND GASTRONOMIC PROFILE)

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Viticulture 2 and agricultural chemistry				96			A	**12**
- mod. Viticulture 2	AGR/03	II	II	48	48	0		**6**
- Agricultural chemistry	AGR/13	II	II	48	48	0		**6**
Viticulture 2 and terroir				96			A	**12**
- mod. Viticulture 2	AGR/03	II	II	48	48	0		**6**
- mod. The soil in the terroir	AGR/14	II	II	48	48	0		**6**
Wine analysis and special wines	AGR/15	III	I	48	48	0	S	**6**
Machinery for the wine industry	AGR/15	III	II	48	48	0	S	**6**
Applied oenology	AGR/15	III	I	48	48	0	S	**6**

Degree in GASTRONOMIC SCIENCES, CULTURES AND POLICIES FOR WELLBEING

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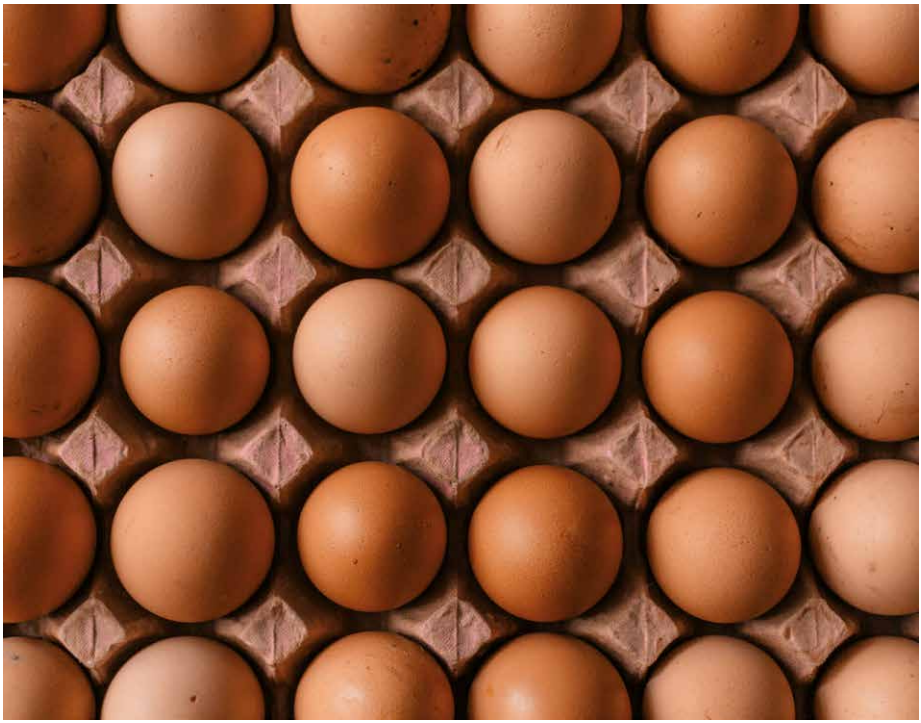


Second-level degree course in AGRICULTURAL AND ENVIRONMENTAL SCIENCES

The Master's programme is a result of the synergy between the DIBAF Department of the University of Tuscia and the Departments of Biology and Biotechnology, Applied Biology and Chemistry of the Sapienza University of Rome. The inter-university course is to train professionals equipped with the scientific bases and the knowledge and skills necessary to perform tasks such as, planning, management, control, coordination and training in the sectors of production, research and development, storage, distribution and administration of food and drink. The course has two paths: Food sciences and technology (Viterbo) and Quality and promotion (Rome), with common activities in the fields of food technologies, food microbiology and food law that will be carried out during class for the University of Tuscia students and in synchronous e-learning for the students of 'La Sapienza' University of Rome. Graduates in Food Sciences and Technology (food sciences and technology) are able to guarantee the safety, quality and healthiness of food products and processed food. They will also use innovative methodologies, Students will also gain the ability to monitor and describe the environmental impact of the processes of food transformation and packaging, in order to manage the procedures for environmental certification and promote the adoption of the best technological practices and/or innovative packaging procedures to mitigate the effects of climate change. The academic programme includes 12 exams that allow you to acquire the scientific and methodological knowledge necessary for those of you who want to work in the vast agro-food sector. Thanks to the freedom of module choice within the curriculum, awarding equal credits for similar types of study and their complementary activities, you can tailor a training plan according to your own interests and/or need to bridge any cultural or professional gaps.

Knowledge and skills

Graduates of the second level degree course in Food Sciences and Technology, food technologies curriculum (LM-70) (Viterbo):

- possess a solid base of theoretical knowledge and practices relative to chemical and microbiological quality control and food safety;
- possess knowledge and competences in innovative technologies for the conservation and transformation of food and in sensory analysis;
- can manage and optimise food industry processes in terms of environmental sustainability and compatibility and can create and carry out research projects and industrial development;
- possess the appropriate professional knowledge and abilities to carry out complex activities of coordination related to the agricultural sector.

Career opportunities

Graduates will be able to work in food companies and in businesses related to the production, transformation, conservation and distribution of food, in the companies involved in large supermarket chains, in state-run and private organisations that plan, analyse, control, certify and carry out scientific research for the protection and promotion of food production, in training organisations and as self-employed professionals, with particular reference to process and product innovation in the food industry, optimisation of conservation and transformation processes, in production processes related to packaging and additives for the food industry, in the development of research and industrial development projects, in the creation of innovative techniques aimed at the evaluation of the quality of finished products and its related health and safety aspects, in the design of new distribution strategies, in the evaluation of the environmental impact and in the creation of strategies aimed at reducing the main impact categories. Food Sciences and Technology graduates will be able to contribute to the innovation of food businesses and to the development of new 4th range products in order to establish new products with stringent specifics, easily recognisable by consumers and therefore able to compete in our global market.

This course prepares students to become food biotechnologists. Graduates of the second level degree course in Food Sciences and Technologies will be able to access the state exam to obtain the qualification to practice the profession of food technologist.

FOOD TECHNOLOGIES (VITERBO)

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Inspection of plant-based products	AGR/12	I	I	52	44	8	S	**6**
Economy and marketing of agro-food products							A	**12**
- Economy of the food sector	AGR/01	I	I	52	44	8		**6**
- Agro-food products marketing	AGR/01		I	52	44	8		**6**
Exam of the optional group A13		I	I					**6**
Exam of the optional group A14		I	I					**6**
Food bioprocesses and advanced microbic methodologies	CHIM/11	I	II	52	44	8	S	**6**
Exam of the optional group AGR/15		I	II					**12**
Exam of the optional group A14		I	II					**12**
Evaluation of the environmental impact of the food industry	AGR/15	II	I	52	44	8	S	**6**
Microbiological techniques for food quality and safety							A	**12**
- Microbiological check for food safety	AGR/16	II	I	48	40	8		**6**
- Starter and predictive microbiology selection	AGR/16		II	48	40	8		**6**
Agro-food system law	IUS/03	II	II	48	40	8	S	**6**
Chosen by the student		II	I / II					**6**
Training		II						**6**
English language		II						**2**
Final test								**16**

List of optional exams

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
GROUP A14 (one exam with compulsory options)								
Food biotechnologies and microbiology*	CHIM/11	I	I	52	44	8	S	**6**
Innovation and entrepeneurship in agro-food biotechnology	AGR/05	I	I	52	44	8	S	**6**
Genetic and molecular techniques for the improvement of the quality of animal production	AGR/17	I	I	52	44	8	S	**6**

*Compulsory for the students who have not taken the 'Food microbiology' exam during their three-year degree course

GROUP A13-1 (three exams, free choice)								
Innovation in the conditioning, conservation and transportation for fruit and vegetables	AGR/15	I	I	52	44	8	S	**6**
Wine analysis and special wines	AGR/15	I	I	52	44	8	S	**6**

[...]

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Processes in the technology of cereals and beer	AGR/15	I	I	48	40	8	S	**6**
Traditional and innovative analytics for the agro-food sector	AGR/15	I	II	52	44	8	S	**6**
4th-generation products	AGR/15	I	II	52	44	8	S	**6**
Chemical analysis of agro-food matrices	AGR/13	I	II	52	44	8	S	**6**
GROUP AGR/15 (one exam with compulsory options)								
Unit operations **Sensory analysis and consumer science*** - Unit operations for the food industry - Sensory analysis and consumer science	 AGR/15 AGR/15	 I	 II II	 52 52	 44 44	 8 8	A	**12** **6** **6**
Innovation in the agro-food industry **Sensory analysis and consumer science** - Enzyme technologies for the food industry - Sensory analysis and consumer science	 AGR/15 AGR/15	 I	 II II	 52 52	 44 44	 8 8	A	**12** **6** **6**

*Compulsory for the students who have not taken the 'Unit operations for the food industry' exam during their three-year degree course

QUALITY AND ENHANCEMENT CURRICULUM (ROME)

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Microbic food biotechnologies	CHIM/11	I	I	52	44	8	S	**6**
Agro-food economy	AGR/01	I	I	48	40	8	S	**6**
Human food and nutrition	BIO/!0	I	I	48	40	8	S	**6**
Exam of the optional group **Safety / characterisation**		I	I					**6**
Innovation in the agro-food industry		I					A	**12**
Sensory analysis and consumer science	AGR/15		II	52	44	8		**6**
- Enzyme technologies for the food industry - Sensory analysis and consumer science	AGR/15		II	52	44	8		**6**
Production improvement and control		I					A	**12**
- Molecular techniques in production and food quality control	BIO/11		II	48	40	8		**6**
- Metabolic biotechnologies and plant improvement	BIO/04		II	52	44	8		**6**
Food technologies processes	AGR/15	I	II	48	40	8	S	**6**
Microbiological techniques for food quality and safety							A	**12**
- Microbiological check for food safety	AGR/16	II	I	48	40	8		**6**
- Starter and predictive microbiology selection	AGR/16		I	48	40	8		**6**

[...]

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
Exams of the optional path		II	I					**6**
Agro-food system law	IUS/03	II	II	48	40	8	S	**6**
Chosen by the student								**12**
Training								**12**
English language								**2**
Final test								**10**

List of optional exams

EXAM	SSD	Year	Sem.	Hour	A.T.	A.P.	S/A	CFUs
GROUP SAFETY / CHARACTERISATION (one exam, free choice)								
Food safety		I					A	**12**
- Food merceology workshop	SECS-P/13		I	56	48	8		**6**
- Integrated protection of the plants related to the food industry	AGR/12		I	52	44	8		**6**
Methodologies for food characterisation		I					A	**12**
- Paired analytical techniques	CHIM/01		I	56	48	8		**6**
- Spectroscopic methods	CHIM/02		I	48	40	8		**6**
ENHANCEMENT PATH (one exam)								
Food science and cultural processes	M-FIL/02	II	I	52			S	**6**
Biodiversity and plant enhancement	BIO/01	II	I	52			S	**6**
History and geography of human food consumption	BIO/08	II	I	52			S	**6**
Landscape ecology and enhancement of agro-food products	BIO/03	II	I	52			S	**6**
Economy and company management	SECS-P/08	II	I	48			S	**6**
QUALITY PATH (one exam)								
Food science and cultural processes	M-FIL/02	II	I	52	48	8	S	**6**
Food anthropozoonosis	VET/06	II	I	52	48	8	S	**6**
Environmental causes of food contamination	BIO/06	II	I	52	48	8	S	**6**
Processes and plants	ING-IND/25	II	I	48	48	8	S	**6**

SCIENCE, TECHNOLOGY AND BIOTECHNOLOGY FOR SUSTAINABILITY

In order to complete training in the agro-food sector the University of Tuscia has launched a PhD course in Science, technology and biotechnology for sustainability together with the University of Molise. The course aims at providing students with the competences they need in order to work in universities, public and private national or international organisations, high-quality research programmes, including interdisciplinary programmes related to:

- agro-food production
- environmental biotechnologies and forest ecology
- Biologic/bioindustrial systems

The Food curriculum training programme includes theoretical and applied studies related to fundamental aspects and applied to the transformation, conservation and food assessment, and criteria for the management of product quality and the environmental sustainability of the processes/processing. The teaching activity is also carried out through cooperation programmes during the annual workshop on the Developments in the Italian PhD Research in Food Science and Technology as well as the National Network of PhDs in Food Science Technology and Biotechnology memorandum of understanding.

The course's interdisciplinary training objectives aim at providing students with: English language competences that can be used internationally; abilities in processing - including statistical processing - the results and written and oral scientific reporting; high familiarity with bibliographic research tools; competence in research manager soft skills (hr management, cost analysis, problem solving, the ability to organise research activities, following their development and adopt the right measures to ensure results are achieved).

SEMINARS, CONVENSIONS; ROUND TABLES, FIELD DAYS

In order to improve the learning and understanding of the notions included in each course, the departments also offer students several seminars held by professionals who often already work in these sectors. These aim at providing students with a different take on several issues, favouring a professional approach to the didactic and scientific approach, so that future graduates can have a holistic view of the different aspects and nuances of a specific problem.

The DAFNE department offers several **seminars**, spread throughout the academic year and sometimes held during important events. Below are some examples:

- Innovative means for plant health protection in agriculture: what there is beyond chemistry", Massimo Benuzzi, CBC Europe;
- "Defence tools for a new organic agriculture: useful insects and mites - case studies", Stefano Foschi, BIOPLANET s.c.a. Cesena;
- "Tree nursery: large-scale productive systems and techniques". Giuliano Dradi. Romano Roncasaglia, Vivai Battistini;
- "Emerging diseases. Case study: Almond Witches Broom in Lebanon", Peter Moubarak, CIHEAM, Bari;
- "Presentation of the book: Verde Brillante. Sull'intelligenza delle piante.", Stefano Mancuso;
- Genetic traceability in viticulture and oenology", Maria Stella Grando;
- "The role of pheromones in the defence of cultivation in Italy - case studies", Francesco Savino, CBC Europe;
- "Selected Topics in Food Sciences", Teodor Trasca, Pro-Rector at the Banat's University of Agricultural ciences and Veterinary Medicine "King Michael I of Romania" (Timisoara);
- "New Trends in Sustainable Agriculture in Romania", Paul Pirsan, Rector at the Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" (Timisoara);

- "Certification in organic agriculture"
  Donato Ferrucci, Bioagricert Lazio.

- "Mendel, Stampelli, Borloug and omics"
  Speaker Michele Stanca

- I sistemi di difesa integrata obbligatoria alla luce della recente normativa sull'utilizzo sostenibile dei fitofarmaci. (Compulsory integrated defense systems in the light of the latest regulations about the sustainable use of phytosanitary products. The role of consultants for integrated defense.
  Speaker Alberto Cardarelli

- "I requisiti legislativi correlati alle strutture di trasformazione dei prodotti agroalimentari" ("The regulations related to the transformation structures of agro-food products*)
  Speaker Donato Scipione

- "I sistemi di autocontrollo igienico sanitario applicati alla produzione primaria" ("Health and safety self-control systems applied to primary production")
  Speaker Elvezio Albanesi

- "Biotecnologie e sviluppo. Esperienze dal Sud del mondo" ("Biotechnologies and development. Experiences from the South of the world")
  Speaker Guido Ruivenkamp (University of Wageningen)

- Day of study "Great Green Wall"
  Speeches by (amongs others): Berrahmouni N/ Dr Sacande M (FAO);
  Monarca D (DAFNE); Casa R/Rossini F (DAFNE);
  Sassolini E (Agron. Trop.)/Tofanelli V (Tec. Prog NARDI spa);
  Vallerani S (Proj. Manag. Vallerani System srl); Ronchi B (DAFNE).

The DIBAF seminars are mainly held during the events labelled "incontri con l'industria alimentare" ("Meetings with the food industry"), that started on the 20th of November, 2012, with a Lectio Magistralis on the challenges and opportunities of the Italian agro-food industry within global change, held by Mr Paolo Barilla, Vice President of Barilla G. and R. Fratelli Spa.

The second meeting, which took place on the 10th of March, 2014, was to do with the **job market for food technologists: current competences and perspectives**. Some of the most interesting talks were the one on the vision and actions of the food industry for sustainable development (Massimiliano Boccardelli, Federalimentare) and the one on current and future competences of food technologists (Enzo Rossi, Director of Conserve Italian, Albinia, GR).

The third meeting, which took place on the 7th of November, 2014, was about **work prospects for enologists and food technologists**. There were other interesting talks, one of which was to do with public intervention aimed at promoting the innovation of the agro-food industry through the synergy with universities (Gianfranco Chiacchieroni, President of the Commission for Economic development of the Umbria region). The second one was about innovations in oenology and the competences of a good oenologist (Massimo Giacchi, Oenologist of the Cantina Novelli, in Montefalco). The third one was about product innovations and the competences of food technologists (Ferdinando Novelli, Gruppo Novelli, Terni).

The fourth meeting took place on the 19th of March, 2015, and it was about **DIBAF for food and wine: the future of food and oenology**. Some of the most interesting talks were the following: the importance of research and training in the food and oenology sectors (Ubaldo Corsini, Corsini Biscotti Srl), Andrea Fabianelli (Pastificio Fabianelli Spa), Paolo Granci (Comoda Service Distribuz. Alimentare srl), Riccardo Cotarella (Presidente Assoenologi). Moreover, director of TG2 Marcello Masi and deputy-director Rocco Tolfa presented "I signori del vino", aired on the Italian RAI 2 TV channel.

The fifth meeting took place on the 24th of November, 2015, and it was about **innovation in the durum wheat supply chain in order to improve quality and environmental sustainability**. The meeting saw the participation of Barilla G. e R. Fratelli Spa e di Buhler AG.

The sixth meeting took place on the 18th of March, 2016, and it was about **innovation in the wheat supply with a view to improving quality and environmental sustainability**. The meeting saw the participation of Barilla G. e R. Fratelli Spa and Interpan Spa.

The seventh meeting took place on the 28th of October, 2016, and it was about **work prospects for food technologists**. The main companies operating in this sector within the Lazio region took part in the meeting: Gentilini, Birra Peroni, Cesare Fiorucci and Findus.

The eighth meeting took place on the 29th of March, 2017, and it was about **quality and certification in the agro-food supply chain**. It saw the participation of certification companies and food companies, including Conserve Italia.

The ninth meeting took place on the 13th of November, 2017, and it was about **product innovation in the beef meat supply chain with a view to improving quality and environmental sustainability**. University experts and food companies such as the Gruppo Bolton took place in this meeting.

The tenth meeting took place on the 23th of April, 2018, and it was about **innovation in industial and artesanal ice cream production**. Some of the participants were Etoile Culinary Campus and food companies, including Unilever, Froneri – Eskigel and Argenti Italian Food.

In order to further improve academic training, DIBAF offers students an oenology workshop and a food technologies workshop, as well as a four-acre experimental vineyard set up by ARSIAL and made available by the director of the Cantina di Montefiaascone Soc. Coop. Agr., Mr Trapè. This is an experimental wine business owned by ARUSIA and managed by Consorzio di Tutela Vino Lago di Corbara DOC and Consorzio Tutela Vini Orvieto. The DIBAF department has signed a convention with these two consorzio for teaching and experimental purposes.

Every year. DIBAF organises a training course in cooperation with Società Preparatori d'uva (Simonit&Sirch, Cormons, Friuli) for people who work in this sector. Students can take part in this training course free of charge. 40% of the registration funds are used by DIBAF for teaching and research activities, as stated by the convention.

Because of the strong links between the University and the local area, the University of Tuscia has organised high-level training courses (Master's courses) to promote high-level professionals that are able to interact with such important sectors as agriculture and the agro-food industry.

The first-level Master's degree course in Management, Enhancement and Promotion of Agro-food Products aims at training professionals who are able to understand the value of our agro-food productions by integrating such elements as tradition, cultural and landscape aspects, quality and marketing, and by using effective promotion strategies for quality products. The Master's degree includes independent teaching courses for any student who wishes to specialise only in some specific subjects and therefore build a cutomised didactic pathway aimed at the acquisition of specific competences. Frontal lessons will be integrated with workshops and practical exercises (10 CFUs) around different thematic areas. Particular attention will be devoted to the in-depth study of sensonal analysis and guided and wine tasting techniques aimed at promoting and identifying the quality of food products through the senses, agro-food communication via the Web and neuromarketing. Nowadays, these are very important elements for the promotion of production and agro-food related activities. The theoretical and practical competences acquired during the study path will be verified and enhanced thorugh case studies analysis, training within different companies, interviews to people working in this sector, practical writing, review and press release exercises, workshops aimed at the creation of multimedia documents, consumer science techniques, the definition of a product's emotional profile, the cooperation towards specific project work with specialised companies.

BILATERAL AGREEMENTS WITH OTHER EUROPEAN UNIVERSITIES

Moreover, through the DAFNE and DIBAF departments, the University of Tuscia developed its international relations in teaching so as to improve its socio-educational perspective, the knowledge and the European intellect of its students, as well as research, with a view to improving the quality of the activities and of the research carried out by experts and professors. The University of Tuscia has therefore estabihed bilateral conventions allowing students and professors alike to move, participate in exchange programs and cross-fertilise within the agro-food sector, with the following European universities:

DAFNE department

Croazia	University of Zagreb
Estonia	Estonian University of Life Sciences – Tartu
Finlandia	University of Helsinki, Faculty of Agriculture and Forestry
France	FESIA - Ecole Supérieure d'Agricolture d'Angers; Centre International d'études Superieures en Sciences Agronomiques - Montpellier SupAgro
Germany	Universität Kassel; Universität Rostock
Greece	Agricultural University of Athens
Latvia	Latvia University of Agriculture
Lithuania	Aleksandras Stulginskis University, Vilnius Gediminas Technical University
Norway	Norwegian University of Life Sciences - Ås
The Netherlands	Christelijke Agrarische Hogeschool Dronten; Wageningen University
Poland	University of Agriculture in Krakow; Szkola Glowna Gospodarstwa Wiejskiego - Varsavia; Uniwersytet Technologiczno- Bydgoszcz, University of Zielona Gora, Adam Mickiewicz University - Pozan, University of life sciences - Poznan, Uniwersytet Przyrodniczy w Lublinie, University of Life Sciences - Lublino
Portugal	Universidade dos Açores
Czech Republic	Mendel University of Agriculture and Forestry - Brno, Tomas Bata University

Romania	Universitatea de stiinte agronomice si medicina veterinara Bucuresti; University of Agronomical Sciences and Veterinary Medicine - Cluj Napoca; Universitatea de Stinte Agricole si Medicina Veterinara a Banatului - Timisoara; Universitatea de Stinte Agricole si Medicina Veterinara a Banatului - Timisoara; Universitatea din Craiova; University of Agricultural Sciences and Veterinary Medicine - Iasi, Ovidius University of Constanta
Spain	Universidad de Castilla La Mancha - Albacete; Universidad Politécnica de Madrid; Universidad Politécnica de Valencia -Escuela Técnica Superior de Ingenieros Agronomos - Valencia; Universidad Europea Miguel de Cervantes -Valladolid; University of Huelva; Universidad de La Laguna - Escuela Tecnica Superior de Ingenieria Agraria - Tenerife, San Cristóbal de La Laguna; Universidad de La Laguna - Escuela Tecnica Superior de Ingenieria Agraria - Tenerife, San Cristóbal de La Laguna, Universidad Politecnica de Cartagena, Universidad de Murcia
Turkey	Dicle University - Diyarbakir; Ege University - Izmir; Mustafa Kemal Universitesi; Harran University, Evran Universite, Bartin University, Akkari University
Hungary	Corvinus University of Budapest; University of Debrecen; University of Pannonia, Szent istvan Egyetem University, Kaposvar University

DIBAF department

Belgium	Université Victor Segalen Bordeaux 2
Greece	Agricultural University of Athens; Chania - Creta
The Netherlands	Wageningen University
Portugal	Universidade de Lisboa
Romania	University of Agronomical Sciences and Veterinary Medicine - Cluj Napoca
Spain	Universidad de Cordoba; Universidad Politécnica de Cartagena - Murcia; Universidad de Jaén; Universidad Politécnica de Valencia - Escuela Técnica Superior de Ingenieros Agronomos - Valencia
Turkey	Namik Kemal University - Tekirdag; Namik Kemal University - Tekirdag

RESEARCH

Research is a very important aspect of the agro-food sector, as it helps introduce innovations in productive processes and products so that these sectors can become more competitive. Moreover, research helps teaching, as it translates into new knowledge and competences which can be used within the market.

Research is often linked to innovation - both process and product innovation. However, as for the specifics of technological innovation within the agro-food and agricultural sector, the distinction between process and product innovation requires some more attention. Process innovation has to do with specific operations, "progressive" innovation processes involving the maintenance of already existing technological approaches or the introduction of highly technological equipment that is capable of increasing productivity or making some activities more efficient. Product innovation within the agro-food sector can be divided into: Introduction of a new product, propagation innovation, formal innovation, formulation innovation, packaging innovation. However, research does not simply mean innovation but also quality and territory / market analysis. Therefore, the University does not simply aim at introducing new processes or products in the agriculture and agro-food sector, but also to develop research in order to improve the organisation of the companies working in these sectors. The University offers the scientific community research activities which aim at describing the advantages that a new managerial approach oriented towards quality and innovation bring to these sectors.

Food industry sustainability is becoming an essential parameter for the development of this sectors, one that can no longer be ignored. This is also important from the point of view of waste use and disposal.

It is not surprising that such considerations have obliged the main world companies dealing in the transformation of cocoa, coffee and palm oil to embrace a virtuous approach that guarantees primary production sustainability and crop maintenance

for those farmers who were forced to find better-paid jobs in their countries of origin due to their appalling financial conditions. This is a well-known phenomena for Italy, that experienced it during the economic boom of the Sixties.

One other important aspect is the university departments' participation in national and international **research projects**.

The agriculture and animal husbandry production research projects are mainly founded on the following themes:

- integrated and conventional organic agriculture;
- traditional and innovative agricultural crops;
- innovative agronomic techniques aimed at reducing environmental impact in agricultural crops (intercropping, use of organic cover crops and groundcover, green manure and organic fertilisation, weed control, a reduction in soil cultivation and more;
- soil features in relation to fertility, CO2 emissions and carbon stock in different agricultural management systems (organic, integrated, conventional) and different applied agronomical techniques;
- performance and agro-ecosystem sustainability analysis, with different hierarchical levels and in different agricultural management systems (organic, integrated, conventional) through the use of indicators;
- genetic selection of varieties which are disease- and water-stress resistant, with very high-level technological and nutritional features;

- the impact of climate change on agricultural and animal husbandry production;
- Animal husbandry, with a focus on food and health safety, animal and environmental well-being (pollutants, quality of cow, goat, sheep and buffalo milk, macrotrauma prevention, animal nutrition and more);
- cereal production, especially durum and soft wheat, for the development of an agronomically superior, disease-resistant, water-stress resistant genotypes of high quality from the technological, nutritional and merceological point of view, and quantitavely efficient (biomass and grain);
- grain legumes (chickpeas, lentils and more), for forage and green manure in order to identify the correct agronomic solutions aimed at determining biomass and yield levels;
- precision farming in order to improve the agronomic management and reduce environmental impact;
- viticulture, in terms of the influence that soil and vine canopy management techniques have on grape quality, quality evaluation to select clones, the study of constitutive and induced natural defence mechanisms, biotic stresses (fungal pathogens) and abiotic (ozone), the characteristics of picked grapes and of grapes after they have been picked and the influence on secondary metabolites composition in wine;
- olive growing in terms of phytosanitary defence, genetic improvement, local germoplasm promotion, the analysis of drupe and oil's nutritional value, and more;
- hazel and chestnut crops in relation to genetic methods for the creation and adoption of new certified clones and phenological, agronomic, productive characterisation and the composition of hazel seeds aimed at widening the types of plants grown;
- kiwifruit, in relation to finding elements which are tolerant to abiotic stress and protection/plant health defense strategies;
- the cultivation of fruit, in relation to the promotion of local germoplasm and the genetic improvement of different species (apple trees, cherry trees, apricot trees, pomegranate trees and more) and the production of fruit with a high health and functional value;
- hops, in relation to the morpho-phenological and productive evaluation, aimed at identifying the most appropriate varieties for central Italy's environmental conditions;
- vegetables (artichoke, tomato, watermelon, melon, cucumber), graft propagation and micropropagation, productivity and product quality, soilless production systems in order to grow highly nutritional products;
- the use of ozone in protected horticulture;
- the bioactive molecule synthesis and their functionalisation with low environmental impact chemical and enzymatic methodologies, such as the use of phenolic extracts derived from food waste, for their application in different sectors (nutraceutic, cosmetic, food and agronomic);

- the promotion of products derived from olive processing waste; high biological activity compounds can be obtained from suhc products, and they can be used in the cosmetic, pharmaceutical and food integration (nutraceutic) sectors;
- the protection and management of agricultural land in order to analyse the sustainability of productive agricultural activities;
- the improvement of mechanisation and mechanised collection techniques related to safety for workers in the arboricolture sector;
- the analysis of financial and social sustainability and the competitiveness of some agro-food production chains (wine, beer, oil and some vegetables) in national and international markets;
- enzyme characterisation and use in solutions, and their immobilisation for the improvement of food safety and quality;
- the production of experimental wines and sparkling wines through microvinification and sparkling making techniques with free and encapsulated yeast;
- the development of new ingredients for the production of innovative drinks.

a.

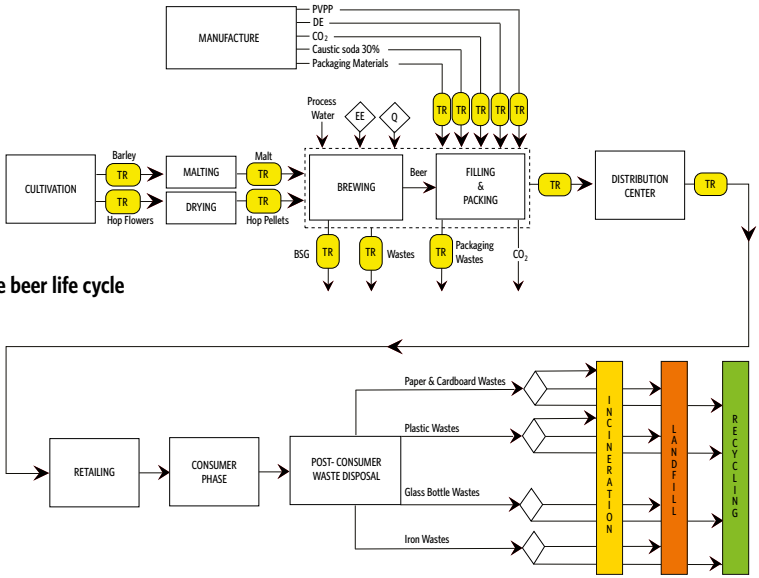
b.

Fourth-range fresh potatoes
a. conservation test in modified atmosphere
b. primary packaging

White and rose wines - no extra sulphites added (2017 harvesting) produced by the DAFNE researchers

Research activities in the food sector are to do with the following:

- chemical-physical and sensory analysis of conventional and functional food,
- food and fermentative biotechnologies (sweeteners, aromas, enzymes and recombinant proteins;
- food chemistry (markers, aroma volatile fraction)
- oil and animal/plant-based fats chemistry and technology;
- fruit and vegetable conservation and conditioning, fourth- and fifth-range products, shell products;
- oenology (white, red, dessert and sparkling wines, grape-withering techniques, polyphenolic, aromatic and sensory profiles, sulphite-free winemaking techniques, local wine yeast selection);
- Food sector (conservation and chemical-biochemical transformation optimisation operations, membrane processes, evaluation of the environmental impact of food choices and production technologies);
- brewing industry (enzymes for non-malted cereal mashing and for the stabilisation of cloudy beer; clarification and stabilisation through microfiltration);
- bioactive molecule recovery from agro-food waste;
- safety and healthiness of plant-based food and processing and preservation areas;
- identification of molecular markers for the monitoring of food quality parameters throughout the whole production chain;
- development of innovative monitoring methods and characterisation of microbic population in food matrices;
- cradle-to-grave environmental impact evaluation of food and products.



Block scheme of the beer life cycle

RELATIONSHIP WITH COMPANIES AND WITH THE LOCAL TERRITORY

The universities are the repository of knowledge, and they are the main means to spread change and innovation in all sectors. A university is a guarantee of growth and improvement for the area in which it is located. This is why it is extremely important that universities are able to develop relationships with the job market through training activities and project work.

The University of Tuscia has started several activities aimed at introducing training and orientation activities in its study courses, which is why it is a fundamental innovation tool for the relationship between university and the job market. The opportunity of coming into contact with the job market before obtaining a degree helps future graduates to enter the job market more easily.

This is why the teachings included in the available degree courses, and especially in the second-level degree courses, are combined with a good number of practical activities in laboratories and on the field. The course academic staff all have numerous contacts for scientific collaboration with research institutions and businesses which operate in the sector of agricultural biotechnology. This guarantees the possibility for you to understand the realities of research and business, through study trips, traineeships and external experimental work.

As far as training activities are concerned, the DAFNE and DIBAF departments have established partnerships with several companies and state-run organisations:

- http://www.dafne.unitus.it/web/interna.asp?idPag=3438
- http://www.dibaf.unitus.it/web/interna.asp?idPag=5951

The University of Tuscia departments have also developed several agriculture and agro-food subsectors thanks to the cooperation with local and national companies.

Some such examples in the sector of agriculture are:

- A new mutated genotype (somaclonal variation) of the Actinidia deliciosa which is resistant to the lack of water and to the fruit dehydration, European plant right, and it is distributed by Battistini Vivai (Martorana di Cesena).

- A mutated genotype alligator (somaclonal variation) of Prunus cerasifera, used as rootstock for stone fruit (peach, apricot and plum trees), resistant to root asphyxia (up to 27 full days of total anoxia), request for European plant right, undergoing negotiation with a group of Italian and European companies.
- Tus3, Tus5 and Tus6 lines of apricot trees, derived from controlled cross-breeding, in order to transfer the skin, red pulp genetic information, guarantee a longer shelf life and a later production, ongoing negotiation with CONVII and Battistini Vivai.
- Red pulp apple, line of the Italian Red Passion Group, where the Red Tuscia is currently awaiting European plant rights through the rectorate.
- Innovative, low environmental impact systems aimed at defending crops from local insect pests; the new biologic and integrated control strategies that have been and are being adopted by several Latium companies allow to increase production and the quality of products derived from herbaceous crops and seed orchards.
- Conservative farming techniques in biologic and integrated production systems for the cultivation of open-field horticultural crops adopted in many companies in the Lazio region; they are based on the reduced tilling or non-tilling of the soil, the use of innovative equipment, organic groundcover with cover crops, with the aim of keeping a high yield, reducing the use of synthetic products such as fertilisers and herbicides, CO2 emissions and in order to increase the organic matter in the soil and biodiversity.
- Innovative selection methods for dairy cattle allow a more targeted and

effective assessment, especially as far as difficult or expensive characters to measure are concerned (for example, fertility, disease resistance, quality of products, adaptability).

- New durum wheat varieties (for example, Cincinnato), selected through the chromosomic engineering method (no-OGM) with high-productivity features, resistance to cryptogamic diseases, better nutritional and aesthetic features of pasta and semolina; durum wheat with modified caryopsis hardness features for the direct production of flour.
- Durum and soft wheat with a high amylose content that gives it a high nutritional and health value (prevention of type-2 diabetes, obesity, CDV diseases and colon cancer).
- New soft wheat types with the deletion of the genes that are responsible for coding some alpha-gliadins (known to be related to coeliac disease) and other wheat varieties where the genes responsible for coding protease inhibitors have been silenced. These are known to be related to asthma.

Among the **numerous transfer experiences**, some examples in the food sector are:

- non-destructive control technologies (Nir-Aotf and E-Nose)
- identification of "altered" hazelnut consignments and post-harvest quality control of hazelnuts for the confectionery sector (Soremartec italia - Ferrero)
- phenolic ripening of grapes for Amarone (Cantina Valpolicella Negrar) and Brunello di Montalcino (Marchesi De' Frescobaldi)
- hazelnut toasting and conservation (Novi - Elah Dufour)

- experimental fruit and vegetables post-harvest technologies (BASF Italia, RHOM and HASS Italia)
- fourth-range fresh potato conservation technologies (Copavit)
- wine technologies for sulfite-free wines (Cantina Falesco, Azienda vitivinicola Barberani)
- new types of sparkling wines from the Castelli romani area (Agricoltura Capodarco; Cantina biologica De Sanctis; Cantina Castello di Torre in Pietra; Azienda agricola Marco Carpineti; Azienda vitivinicola Francesca Cardone Donati)
- selection of yeast and lactic bacteria with ß-liasic activity in order to free the aromatic compounds of different varieties (Cantina Sergio Mottura; Antica Cantina Leonardi; Cantina Casal Pilozzo; Cantina Casale Del Giglio)
- clarification and stabilisation technologies of cloudy lager (Birra Peroni)
- biotechonological production of vanillin from ferulic acid, capsaicin and agro-food waste (Solvay-Rhodia; Gnosis)
- innovative microwave stabilisation technologies of plant-based products due for freezing (Compagnie Surgelati Italiana - Findus)
- electrodialysis technology to desalinate soy sauce (Unilever Italia)
- technologies for the transformation of meat (Umbria Food Valnerina, Poggino Salumi, Associazione Italiana Allevatori)
- carbon footprint evaluation studies (Birra Peroni; Acqua Claudia; De Matteis Agroalimentare)

Lastly, there are numerous cooperation projects with agro-food companies in the Lazio region. For example, those carried out within the Programme for the rural development of Lazio 2007/2013 - MISURA 124 "Cooperazione per lo sviluppo di nuovi prodotti, processi e tecnologie, nel settore agricolo, alimentare e forestale" → (*http://www.agricoltura.regione.lazio.it/psr/misure/?vms=15&id=Cooperazione-per-lo-sviluppo_15&ref=contenuto&pagetab=0*).

A series of services on behalf of third parties and aimed at companies are also available at the University of Tuscia departments. Among these are:

- the interdepartmental centre of electron microscopy (Centro Interdipartimentale di Microscopia Elettronica - CIME),
- the didactic-experimental agricultural company "N. Lupori"
- a section which is in the process of being developed and which is dedicated to sustainable innovation in the food sector, in the Rieti and Viterbo areas: hazelnuts, dairy products (including ice cream), meat and meat products, olive oil, wine and beer, pasta, bread and bakery products, small niche production.
- a certified laboratory to analyse arsenic in food and water;
- a sensory laboratory (ISO 8589:2007).

The university's departments offer advanced biochemistry, molecular biology and plant/micro-organisms biotechnologies workshops, advanced analytical chemistry workshops (spectroscopy, cromatography, conventional spectrometry and NIR). As far as food technologies are concerned, the university has watertight cells

with equipment for controlled atmospheres for fruit and vegetable conditioning; fermentation and mechanical and pneumatic stirring units with control and data acquisition units; a pilot unit for micro-, ultra- and nano-filtration and reverse osmosis; an electrodialysis pilot unit, dynamometers and reometers for reometric analysis.

SPIN-OFF

The University of Tuscia has activated a few spin-offs in order to further cooperate and liaise with companies.

Phytoparasites Diagnostics srl (PhyDia)

[Spin-off/innovative startup - University of Tuscia (www.phydia.eu)]

Formed by 5 researchers who have studied at the University of Tuscia and possess a high profile of professional and scientific experience, both in the lab and on the field), in the sector of phytodiagnostics of harmful organisms in the agro-food area, this innovative startup has laboratories aimed at working in agreement with international regulations (European and Mediterranean Plant Protection Organization, EPPO).

PhyDia is recognised both by the Servizio Fitosanitario Centrale (SFC) of MIPAAF and by the Servizio Fitosanitario Regionale (SFR) for isolating, handling, studying and conserving all harmful plant parasites, included quarantine organisms. The spin-off can count on state-of-the-art scientific equipment that can quickly respond to any agro-food need in terms of phytoparasites and guarantee good results and competitive prices. It also offers a good level of service for the numerous needs of the agro-food sector (water and soil analysis, multi-residual analysis, varietal recognition through genomic footprinting, HACCP, etc.). PhyDia is involved in training, dissemination, research and technology transfer at a regional, national and international level; it coordinated several project of great public relevance and it is cooperating with an increasing number of private companies.

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IDEA 2020 A University of Tuscia spin-off

IDEA 2020 is a University of Tuscia spin-off that operates in the area of cooperation for development through strategies and approaches that combine financial growth, environmental responsibility and social inclusion.
The IDEA acronym stands for 'Innovation and Development for Agriculture' and it refers to the strategic "Europe 2020" document, which envisages a European development strategy combining innovation, development, environmental sustainability and social cohesion.
The IDEA 2020 spin-off stems from the awareness that there is a need to adopt a multifunctional view on agriculture when planning agricultural and rural development actions in emerging countries.
IDEA 2020 is capable of taking in the latest developments of interdisciplinary research and transferring them to operational activities in an agricultural and environmental development context, both at a national and at an international level. The work group has the competences needed to work in projects dealing with innovative agricultural systems with a low environmental impact as well as forestry-environmental projects and socio-economic projects.
The role of this spin-off is that of understanding and taking in the development in research concerning different disciplines to then apply it to each different phase of a specific project. The spin-off acts as a connection between university research and the management and development of operational projects.
IDEA2020 also offers the University of Tuscia researchers some useful planning assistance in projects that could receive sponsoring within research and innovation European Union projects (Horizon 2020), international cooperation and development (EuropeAir) and training and education (Erasmus plus). The long-standing experience members and cooperators can count on allow the spin-off to offer good assistance both in the planning and in the operational management phases of each project.

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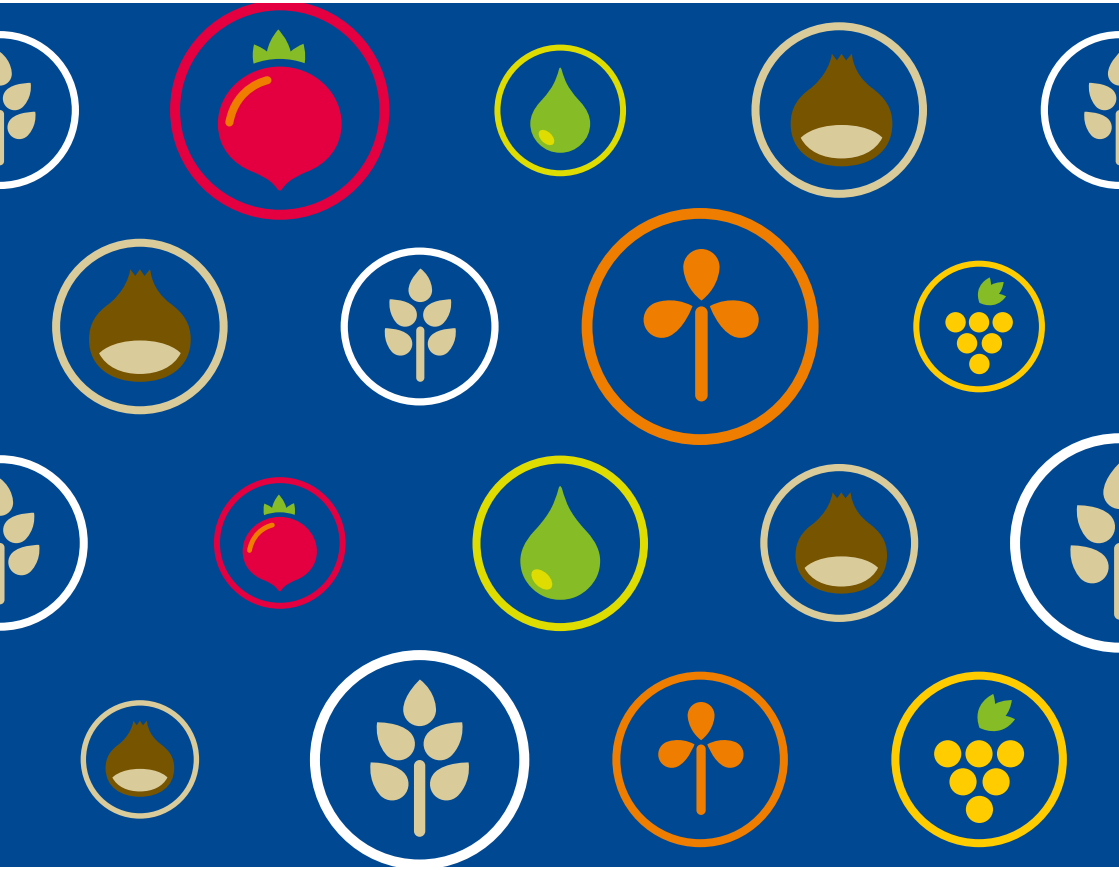

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