



IRTA[®]

**ACTIVITY
REPORT**
2021

 Generalitat
de Catalunya

IRTA[®]

**ACTIVITY
REPORT**
2021



PRESENTATION

2

THE NEW
ORGANISATION

4

7 PEOPLE
7 ARTICLES
8 BUDGET
8 PROJECTS
9 CONTRACTS

10
SCIENCE NEWS

6

SIX
STRATEGIC
INITIATIVES

INDUSTRIAL
PROPERTY

19

KNOWLEDGE
TRANSFER

20

SOCIETY

24

22

INSTITUTIONAL
RELATIONS

28

OUR
CENTRES

AN ALLY WHEN FACING GLOBAL CHALLENGES

The year 2021 has seen the renewal of Catalonia's government and the creation of the new Department of Climate Action, Food and Rural Agenda (DACC), for which I have the honour of being the Minister. The new Department incorporates the former competencies of the Department of Agriculture, Livestock, Fisheries and Food (DARP), and IRTA is now attached to it.



TERESA JORDÀ

Minister of Climate Action,
Food and the Rural Agenda
and President of IRTA

In the current context of climate emergency, the agri-food sector faces major challenges including increased pests and diseases, soil degradation, ocean acidification, and droughts and floods that will become more intense and frequent. For this reason, the DACC must strive to ensure that Catalonia can face these challenges in a coordinated and harmonious way, combining the needs of agri-food and the sensitivity of the most environmentally aware sectors. IRTA, as a key institute in our country dedicated to agri-food research and innovation, has a pivotal role to play in these challenges.

IRTA provides solutions so that we can continue to produce safe and healthy food by optimising resources such as water and soil, reducing the use of pesticides in pest control, cutting food waste, managing livestock waste in a circular way, finding new sources of protein, and assessing the potential of Mediterranean crops to fix carbon dioxide in the soil, among many others. This list would make little sense without the last link in the chain, in other words, transferring this knowledge to the sector and making it available to society. On the one hand, because the production and processing sector is the final recipient of the knowledge generated by IRTA, and only by putting this knowledge into practice will the sector become more competitive and resilient. And on the other, because, as a public research centre, IRTA has a duty to communicate its research to the public so that they may become more critically aware of the issues and be in possession of reliable and quality information to help them make informed decisions in their daily lives.

The report you have in your hands is a summary of the great work carried out over the last year by the nearly nine hundred people who make up IRTA. A team of people who work with determination and enthusiasm to spearhead the transformation of our food systems towards sustainability and whom I would like to take this opportunity to congratulate and thank for their work, which is already complex under normal conditions, but which has been even more so in the context of the COVID-19 pandemic.

It is difficult to find a single word to sum up IRTA's activity in 2021. It could be *effort*, *enthusiasm*, *enterprise*. Or, perhaps better still, *integrity*, *commitment*, *respect for the environment* and *excellence*, the values that, together, we have chosen to define our institute. But this year I have chosen none of these. Instead, I have selected another that aptly represents what the creation of the new Department of Climate Action, Food and Rural Agenda (DACC), of which IRTA is a part, symbolises: *balance*.

With the creation of the DACC, two apparently antagonistic worlds, the environmental and the agri-food, now coexist under the same umbrella. Many people see a potential problem in the fact that environmental policies must work hand in hand with agricultural policies, but from the perspective of research and knowledge, I see an opportunity to consolidate a relationship that has no choice but to function effectively so that we can face the challenges of the climate crisis. This relationship is based on the balance between the need to produce food to supply the population and the need to conserve biodiversity and natural resources; the knowledge generated and transferred by IRTA is, more than ever, essential to make this possible.

The image on the cover of the report you are holding in your hands illustrates this balance between the productive sector and the natural environment. Rice cultivation, deeply rooted in the culture and landscape of the Ebro Delta, not only coexists with a protected natural area that is extremely vulnerable to the effects of climate change but is intrinsic to it and shapes it. IRTA has spent years conducting research into areas such as the ecology of marine and inland waters, aquaculture, plant protection and extensive crops, which have resulted in the viability of this balance.

In 2021, we have also seen that to make the sustainable transformation of food systems possible, there is a pending issue: we must bridge the digital divide in agriculture and livestock farming. Digitalisation can help to optimise the use of resources like water, ensure the traceability of food, guarantee its origin and safety, improve the sustainability of production, and contribute to reducing food waste, among other things. To facilitate this, we need technologies adapted to the reality of our sector, we must train and educate people so that they can apply these tools to their full potential, and business processes, models and strategies need a complete overhaul. Of course, we must not forget that the digitisation of food systems is at the heart of one of the six strategic scientific initiatives that we want to promote in a cross-cutting manner through various research programmes and disciplines.

THE YEAR OF *BALANCE*

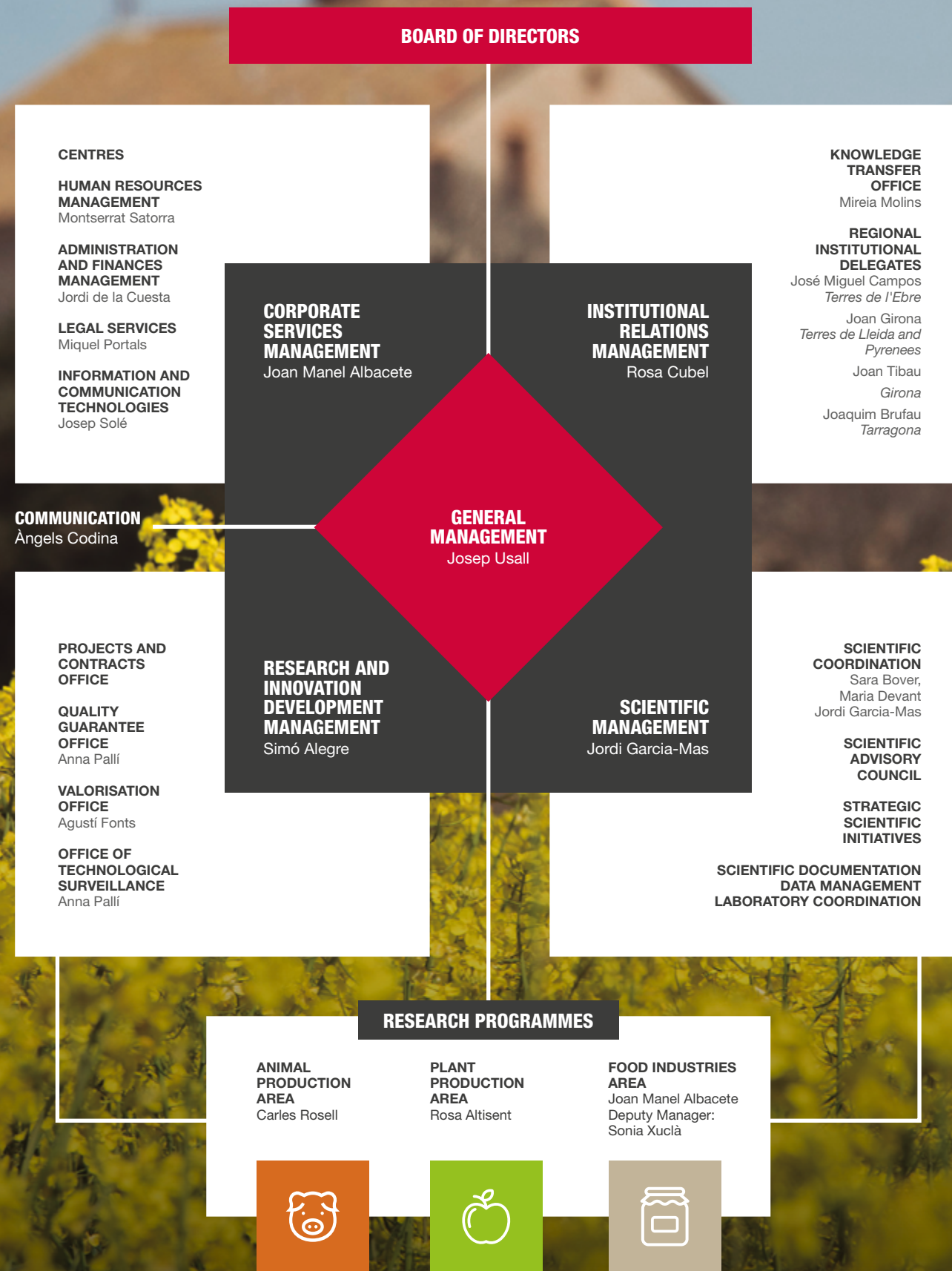


JOSEP USALL I RODIÉ

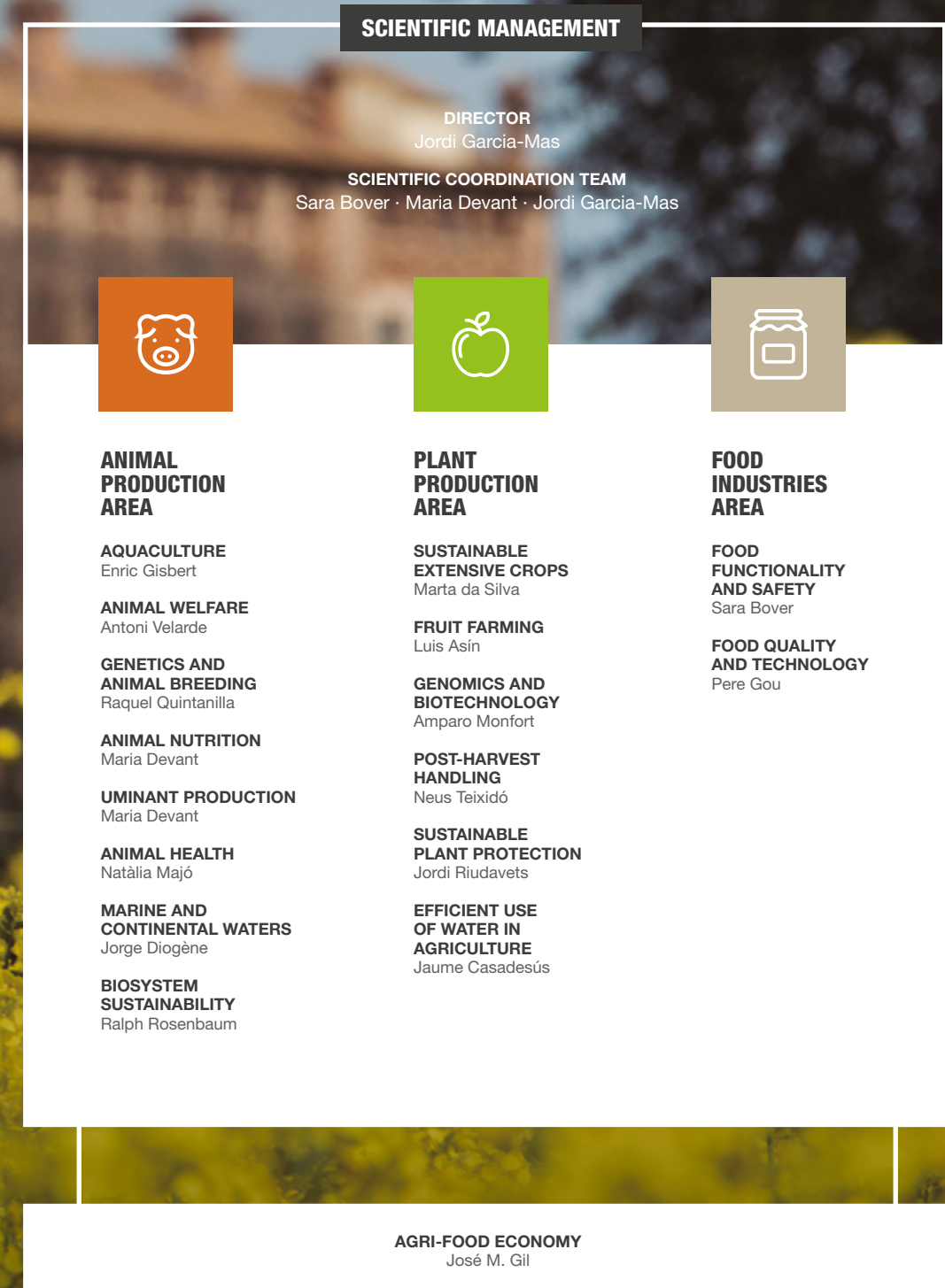
CEO of IRTA

I could write so much more about all the work we have done this year, but I don't want to go on any longer. I invite you to leaf through the following pages, a very synthetic reflection of the good work done by all the people who make up IRTA and who, day after day, whether in the lab, the field or on the farm, in front of a computer, in a meeting room or behind a reception desk, do their bit to make our institute useful for our country and to contribute to making a better world.

THE NEW ORGANISATION



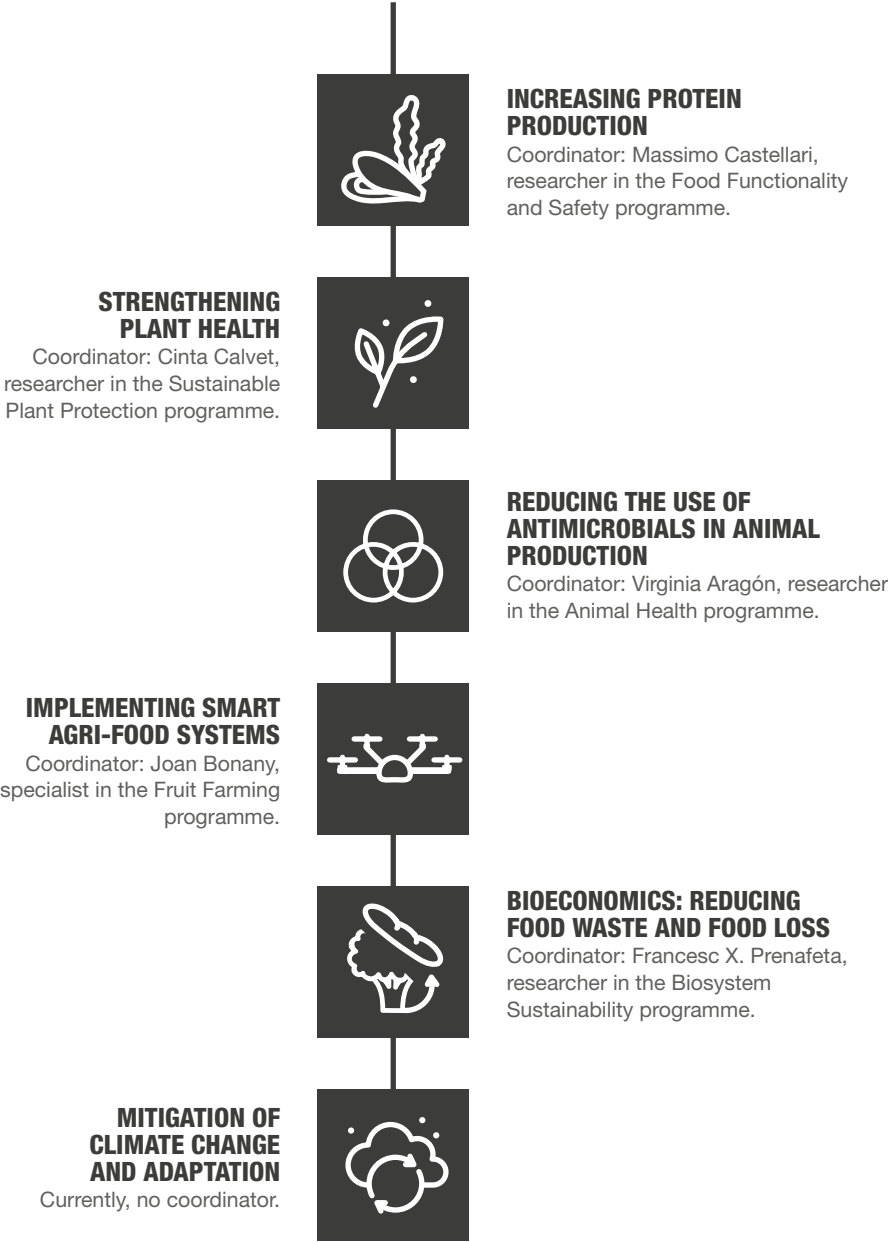
On 21 September, the Executive Committee agreed on a series of changes to IRTA's organisation with the aim of improving its efficiency and operability. These changes came into effect on 1 October. Moreover, in terms of the scientific structure, in 2021 the Agrosystems Sustainability Area disappeared and the programmes that formed part of it were integrated into the Animal Production Area, with the exception of the Agri-Food Economics unit, which became a cross-cutting programme.



SIX STRATEGIC INITIATIVES

Last year, IRTA presented the Strategic Plan 2020-2023, a document that highlights the objectives —to produce quality food, implement technological solutions and develop sustainable food systems— that should guide the institute's activity.

Within this framework, in 2021 the six strategic initiatives that are to be promoted transversally through various research programmes and disciplines were launched, and coordinators were appointed in most cases:



THE PEOPLE

882
PEOPLE

389
MEN

493
WOMEN

10.7%
PhD students

11.2%
Affiliated staff

78.1%
IRTA STAFF

26%
R&D staff

74%
SUPPORT STAFF

SCIENTIFIC PRODUCTION



28,450
CITATIONS

507
SCIENTIFIC
ARTICLES

PUBLISHED IN JOURNALS OF THE WORLD
OF SCIENCE CORE COLLECTION

18
DOCTORAL
THESES
DEFENDED



18
BOOKS AND/
OR BOOK
CHAPTERS



66%
ARTICLES WITH INTERNATIONAL
CO-AUTHORS

66%
ARTICLES PUBLISHED
IN Q1 JOURNALS

337
COMPETITIVE
PROJECTS



97
TOTAL IN
CATALONIA



187
TOTAL IN THE
REST OF SPAIN



53
TOTAL AT INTER-
NATIONAL LEVEL

236

ACTIVE PROJECTS
IN 2021

22.5% started in 2021

↑53

77
PROJECTS

↑9

108
PROJECTS

↑33

51
PROJECTS

↑11

101

GRANTS TO
RESEARCH STAFF

32.7% started in 2021

↑33

20
GRANTS

↑6

79
GRANTS

↑26

2
GRANTS

↑1

AGREEMENTS
AND
CONTRACTS



44

COUNTRIES

5

CONTINENTS

4.9
M€

VALUE OF THE NEW
BUSINESS WITH
INTERNATIONAL
COMPANIES

1,652
CONTRACTS



530

CATALAN CLIENTS



CLIENTS

389

CLIENTS FROM THE
REST OF SPAIN



188

INTERNATIONAL CLIENTS



1,107

INCOME

33.0%

STRUCTURAL CONTRIBUTION FROM
THE GENERALITAT DE CATALUNYA

32.6%

RESEARCH AND
INNOVATION PROJECTS

30.7%

CONTRACTS AND SERVICES
WITH COMPANIES

3.7%
OTHERS

50,761,546 €

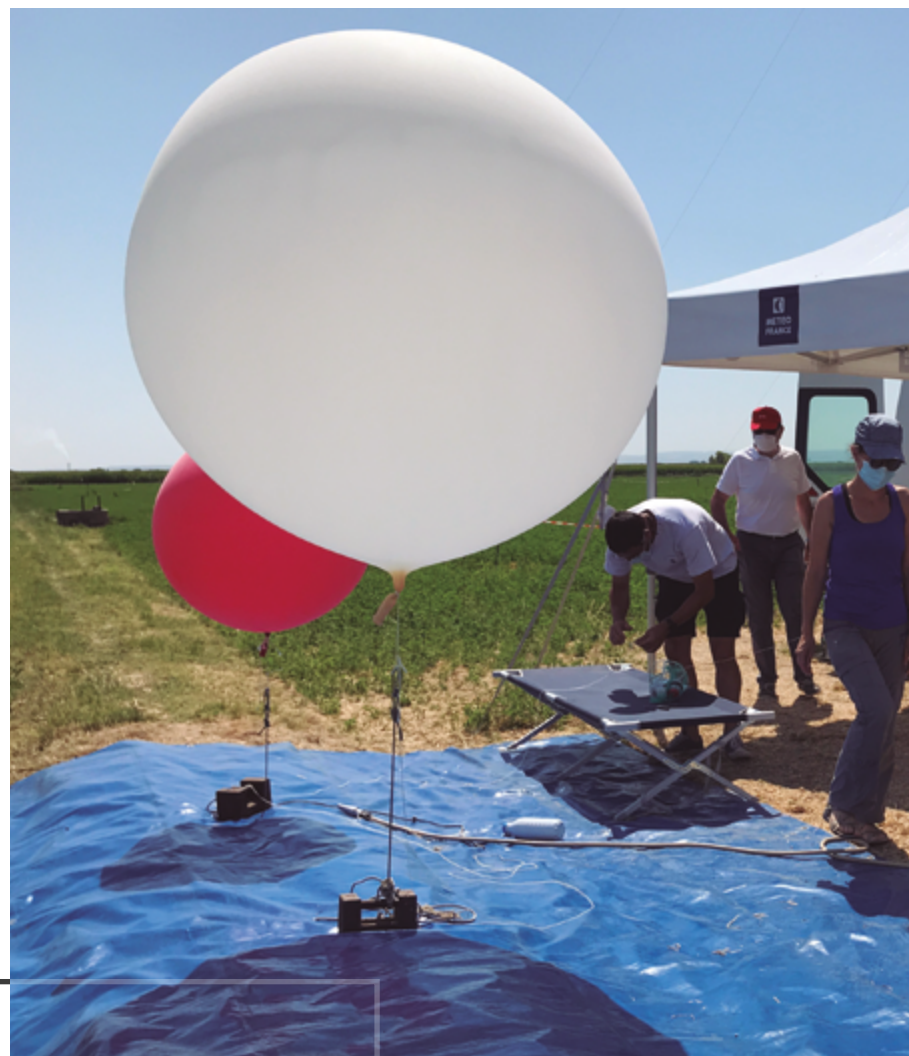
INCOME

SCIENTIFIC NEWS

PLANT PRODUCTION

Researchers from the Fruit Farming programme identify **thirteen new local olive tree varieties** in Pallars Jussà

These have very interesting qualities in terms of taste and health benefits, and their genetic material has been incorporated into IRTA's germplasm bank of Catalan olive varieties, created in 1987 at the Mas Bové centre. The aim of the study was to promote and enhance the cultivation of olive trees and olive oil in the Pallars Jussà region, to achieve oil of the highest quality and with unique characteristics that preserve the region's heritage and tradition.



Lleida's agricultural model takes centre stage in a world study on **climate prediction and water management** in agriculture

In July, scientists from NASA, the European Space Agency and other international organisations deployed various meteorological and Earth observation devices in Pla d'Urgell as part of the LIAISE project, in which IRTA is participating. The aim is to improve meteorological forecasts of evaporation and precipitation and to obtain tools to more efficiently manage irrigation water in the semi-arid regions of the Mediterranean basin.

Gene that makes plums purple identified

The presence and accumulation of the antioxidant pigment anthocyanin determines the colour of plums, and its synthesis is known to be regulated by MYB10 genes. Researchers at IRTA and CRAG have identified the gene that determines the skin colour of the Japanese plum, the most abundant plum on the market for direct fresh consumption. The study provides a very efficient tool for breeding programmes involving the early selection of colourful and non-colourful fruits.





New rice varieties to secure crops in the context of climate change

The effects of climate change and pests threaten rice crops in the Ebro Delta, in particular the salinity of the fields caused by the intrusion of the sea, apple snails and rice blight, a disease caused by a fungus. In order for this to remain viable, IRTA and the Valencian Institute for Agricultural Research (IVIA) are developing new rice varieties that are tolerant to salinity and resistant to fungus, a "simple and economical solution for rice farmers", according to Mar Català, from the Sustainable Extensive Crops programme.

A method developed by IRTA makes it possible to cultivate eight Catalan **bracket fungi**

The production of these fungi, including the beefsteak fungus, makes it possible to incorporate species linked to local tradition and which have considerable gastronomic potential, into a market that has been dominated by foreign varieties. The project will make it possible to de-seasonalise their consumption and reduce the harvesting pressure on populations in Catalan forests, as well as boosting the circular economy thanks to the use of substrates from the forestry industry.



The VISCA project, considered "key" for the EU in the European climate change adaptation strategy

IRTA is one of the partners in this European project, which ended in 2020 and whose main aim was to contribute to making the wine sector more resilient. One of the keys to the project was the crop forcing technique of pruning and late regrowth, originally designed to delay the grape ripening period, as this gives the vineyard a second chance if diseases appear and also improves the quality of the grapes.



A parasitoid is released into citrus groves to control the **new mealybug** from South Africa

Commissioned by the DACC, the parasitoid *Anagyrus aberiae* was released for the first time in May into a citrus field in Tortosa. The aim is to control the South African mealybug, *Delottococcus aberiae*, a new pest that is causing serious damage to the fruit, making it unmarketable, and which can damage up to 40% of the crop. The parasitoid is being bred at IRTA Amposta and will be released in the affected fields in Terres de l'Ebre on a regular basis.

The initiative is part of a strategy to promote biological control in order to reduce the use of phytosanitary products.





ANIMAL PRODUCTION

Antibiotic resistance can be transmitted from animals to humans

This is the conclusion of a study led by IRTA after the same colistin-resistant bacterial plasmid was found in a farmer and his livestock. The animals had been treated with the drug and, therefore, the resistance gene must have been transmitted from the livestock to the human. Colistin is an antibiotic that is only given to people in hospitals and as a last resort against serious bacterial infections.

Duroc pig genetics studied to produce more disease-resistant pigs and reduce antibiotic use

Researchers from the Genetics and Animal Breeding programme have studied thirty genetic traits related to immunity, haematology and stress parameters in Duroc pigs, and identified sixteen genes that could explain their variability. The study provides knowledge that can be applied to genetic selection to obtain more robust pigs and thus reduce antibiotic use, a challenge not only for animal production but also for global health due to the increase in antimicrobial resistance.

SARS-CoV-2 infects and spreads better thanks to molecules present in immune system cells

The journal *Nature* published an international study involving IRTA which demonstrates that lectins, molecules present in some immune system cells, help the virus to enter target cells and, therefore, promote SARS-CoV-2 infection. This finding also explains one of the mechanisms by which the new coronavirus spreads more efficiently through lung tissue and how lectins can modulate the ability of antibodies to block the virus.



Welfair certification, an international standard in animal welfare

In June, it was announced that Welfair would expand into South America. This certification, approved by IRTA with the collaboration of the Basque Institute for Agricultural Research and Development (Neiker), and the first to have the scientific backing of the European Union, has been chosen as the international standard thanks to its rigour, the unification of welfare criteria and its multi-species scope.

Advice on improving animal welfare during long-distance transport

Experts from the Animal Welfare and Ruminant Production programmes prepared a study for the European Parliament's Committee of Inquiry on the Protection of Animals during Transport (ANIT). The study includes measures and recommendations for improving the transport of unweaned animals and pregnant cattle, sheep, goats and pigs, two outstanding issues in the evaluation of the regulation on the protection of animals during transport.



More sustainable and competitive fish, a strategy for relaunching Mediterranean fish farming

The MedAID project, coordinated by IRTA and the Mediterranean Agronomic Institute of Zaragoza (IAMZ-CIHEAM), has diagnosed the productive, environmental, economic and social constraints of aquaculture throughout the entire value chain. "We wanted to approach it from a multidisciplinary and holistic perspective", summarises Dolors Furones, a researcher in the Aquaculture programme and the project's scientific coordinator.



Salicornia and lettuce grown in tanks with fish, a **circular bioeconomy model**

As part of the H2020 NewTechAqua project, two experiments were run at IRTA La Ràpita in which, using aquaponics, plants were grown directly in water enriched with fish faeces and the remains of their feed. The result: 90 kg of lettuce and 250 kg of salicornia in just 18 square metres. This study demonstrates, for the first time, that aquaponics is effective for growing plants from salt-rich environments.

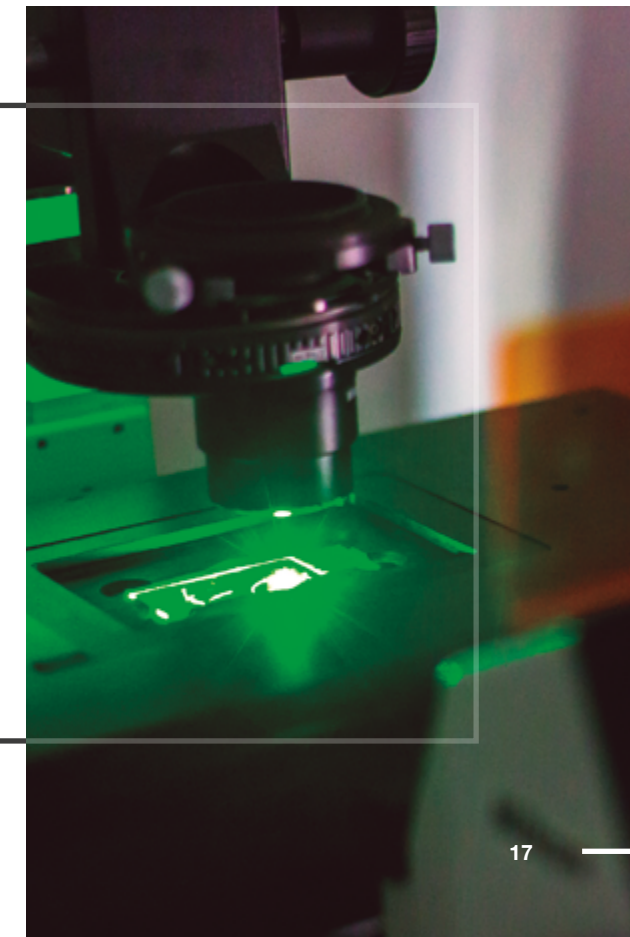
Dyeing irrigation water to trace the dispersion of potential pollutants across the Ebro delta

Stemming from certain bivalve mortality phenomena in the Ebro delta, researchers from the Marine and Continental Waters programme and the UPC have devised a model for studying the possible chemical or microbiological contamination dispersed into Fangar Bay by irrigation water. It involves dyeing the water with a reddish dye, rhodamine, in order to follow the water discharge effluent and delimit the most affected areas.



Catalonia will have the first state-of-the-art confocal microscopy unit in southern Europe in a **High Biosafety Level lab**

IRTA-CReSA will receive one million euros from the Spanish Ministry of Science and Innovation's National Programme to install this technology. This bioimaging platform will facilitate 3D reconstructions of different cellular components and enable detailed studies of infection processes, as well as the precise definition of therapeutic targets for the development of drugs or vaccines.



FOOD INDUSTRIES

Cheese factories achieve **zero waste** by producing kefir and a beverage for athletes

Montbrú and IRTA are working together to add value to goat's milk whey, a dairy by-product with a high nutritional value. 300,000 tonnes of whey are generated annually in Spain, and currently it is used either for animal feed or thrown away. As part of the XERIGOT task force, they are developing a milk drink for athletes and a kefir; the results will be transferred to the Catalan cheese sector to make it more competitive.



A **mobile CAT** scan available to the whole sector

Computed tomography (CT) technology makes it possible to obtain images of the inside of bodies. It can be applied to live animals, carcasses or pieces of meat, or other foodstuffs such as fruit or fish. Until now, it has only been available to technology centres, but in 2021 IRTA acquired a mobile device. Installed inside a lorry, it allows this technology to be applied anywhere, making it available to farms, research institutions, slaughterhouses and other food industries.

INDUSTRIAL PROPERTY

In 2021, IRTA applied for two patents and five variety registrations. It currently has five patents, four of which are being exploited by IRTA. In addition, the following varieties are protected or in the process of being protected at the international level.

VARIETIES THAT ARE PROTECTED OR BEING PROTECTED



Consumer behaviour experts from IRTA and bonÀrea lead a pilot project to transmit "from farm to fork" values

The Think-Local task force combines classic consumer behaviour techniques with neuroscience to find out how customers perceive the bonÀrea brand, its products and shopping areas. The aim is to transmit the company's vertical integration values through its physical and online establishments, improve bonÀrea's image and stimulate the consumption of its local products.



A **bioreactor** that makes a thirty-minute process possible in just five

One of IRTA's patents is the GreenTray® system, a bioreactor that reduces the handling time of *in vitro* plant cultures by 80%; this year a patent has been applied for in the United States and Mexico. The system consists of a glass or plastic flask and a plastic tray attached to the flask; the liquid nutrient for the seedlings is supplied through a tube. The plant material remains inside the flask the entire time; when it must be handled, the entire tray is removed, without needing a scalpel or tweezers, and the shoots are handled together rather than shoot by shoot as in other systems.

One of the main hurdles in *in vitro* plant production is labour costs, as these can represent up to four-fifths of the total production cost. The global greenhouse, nursery and flower market generated more than 290 billion euros in 2020, 0.1% of which was from plant propagation. Implementing technology that facilitates handling, like GreenTray®, will, according to the system's developers, mark "a turning point" in the way companies work.



KNOWLEDGE TRANSFER

The **online format** gains ground

In the context of the COVID-19 pandemic, it was not possible to hold on-site events, and the online format became very popular. While IRTA's commitment has been to prioritise on-site events wherever possible, there is no doubt that 2021 has seen the consolidation of the virtual format. The number of participants registered for some of the conferences makes this very clear. To give three examples, one for each area, the number of participants has been:

301 

"Unpacking Regulation (EC) 2073/2005. Key aspects for guaranteeing food safety up to the moment of consumption"

197 

"The West Nile Virus: where do we stand?"

482 

"3rd Scientific-Technical Meeting on Remote Sensing and Precision Agriculture"

This reached an audience that would have been materially impossible in a solely on-site format.

Back to the countryside, back to Mollerussa!

This was the slogan of this year's Fruit Growing Week, which, thanks to the return to normality following the COVID-19 pandemic, was held in an on-site format. From 20 to 22 October, the leading trade fair for the fruit sector in Southern Europe hosted 71 stands and attracted 2,000 visitors. The almond, peach, nectarine, apple and pear were the stars of the technical presentations, accompanied by field demonstrations at the experimental sites in Mollerussa and Les Borges Blanques.

43,583

ATTENDEES



809
ACTIVITIES

55.3%
On site

44.7%
Online



TECHNICAL
PUBLICATIONS

126

>8,000
REGISTERED USERS

150,096
VISITS



TRANSFERENCIA.IRTA.CAT PORTAL

INSTITUTIONAL RELATIONS

16 MARCH



Ramon Tremosa, Minister of **Business and Knowledge**, visits Torre Marimon to get to know IRTA and its needs in terms of resources to tackle the **infrastructures plan** and attract new research staff.

07 MAY

The **Association of Agricultural Engineers of Catalonia** reinforces its alliances with IRTA to promote and disseminate technological developments in the agri-food sector.

22 SEPT.

Sorigué and IRTA renew their framework agreement to develop new research in the fields of **agri-food and water**.

11 NOV.

IRTA and the UdG join forces in agri-food research thanks to the signing of an agreement that will enable closer and more effective collaboration between researchers and lecturers at the two institutions.



2021

2022

The Catalan Minister for **External Action, Institutional Relations and Transparency**, Bernat Solé, visits Fruitcentre and explores possible collaborations with IRTA in the framework of the **2030 agenda**.

04 FEB.

IRTA signs an **agreement with the Canal d'Urgell Irrigation Community** with the aim of collaborating in areas including animal and plant production, food industries, agrosystems and the environment, and the agri-food economy.

Gemma Geis, Catalan Minister for **Research and Universities**, visits the centre at La Ràpita and describes IRTA as "a national structure that unites the region and provides a backbone for research".

27 JUL.

IRTA celebrates **institutional roundtables** in the counties of Girona, Lleida and Pyrenees, Camp de Tarragona and Terres de l'Ebre with the aim of informing local agents of the activities it carries out and understanding their **research and innovation needs**.

25 NOV.

The **Centre for Digital Innovation in Agri-food and Forestry of Catalonia** is created. Promoted by Lleida Provincial Council, this involves a dozen entities, including IRTA.

25 & 26 NOV.

IRTA takes part in the **Datagri** forum in Lleida, aimed at promoting digital transformation in the agri-food sector.

13 MAY



OCT. & NOV.



SOCIETY

As a public research institute, we have a duty and a commitment to pass on the knowledge we generate to the public, and not only for the sake of transparency, but also to promote scientific culture in society and to contribute to a critical spirit and informed decision-making.

105

EDUCATIONAL ACTIVITIES

4,500      

PEOPLE WERE ABLE TO LEARN MORE ABOUT OUR RESEARCH THROUGH WORKSHOPS, LECTURES AND VISITS TO RESEARCH CENTRES

City and Science Biennial 2021: Meetings with schools, micro-talks and debates

The events of the City and Science Biennial 2021 were held from 8 to 13 June in venues ranging from La Pedrera and the Biomedical Research Park, to public squares in Barcelona. As a new feature of this year's edition, the science outreach event included the Science Festival and a series of activities under the umbrella of the #100tificas initiative, which aims to raise awareness of female research talent.

In relation to IRTA's own female research talent, the researchers Marta Balsells, from Post-harvest Handling; Marta Terré, from Ruminant Production, and Júlia Vergara-Alert, from Animal Health, had the opportunity to explain their work and interact with 9 and 10 year olds. Balsells explained how the Post-harvest programme can improve fruit and vegetable conservation and reduce waste; Terré, talked about the role of cows in ecosystems and how research can help to minimise the environmental impact of milk and meat production, and Vergara-Alert, spoke about COVID-19 research.

The Biennial also included a debate on the importance of the microbiome in the gut and on the Earth, featuring Marc Viñas, a researcher in the Biosystem Sustainability programme and head of the cross-cutting microbiome initiative.

Finally, as part of the Science Festival, there was a demonstration on how research is carried out into highly contagious viruses such as SARS-CoV-2, a workshop on the manure composting process, and two micro-talks, one on how important biodiversity is for everyone's health, particularly that of amphibians, and another aimed at debunking myths about livestock farming.



Once again, we participated in the European Research Night

On 24 September, 300 cities from thirty countries all over Europe took part in this public event designed to take research and innovation to the public in a simple and fun way. In Lleida, the University of Lleida coordinates the activities, and the Fruitcentre took part with an open day.

They offered guided tours and workshops on the importance of hand and mask hygiene, plant photosynthesis and NIR technology for classifying fruit according to its quality and state of ripeness. The CReSA also took part in the European Research Night, in this case, Judit Guitart, a PhD student in the Animal Health programme, gave a talk at Cosmocaixa on antimicrobial resistance and diagnostic techniques to reduce its emergence.

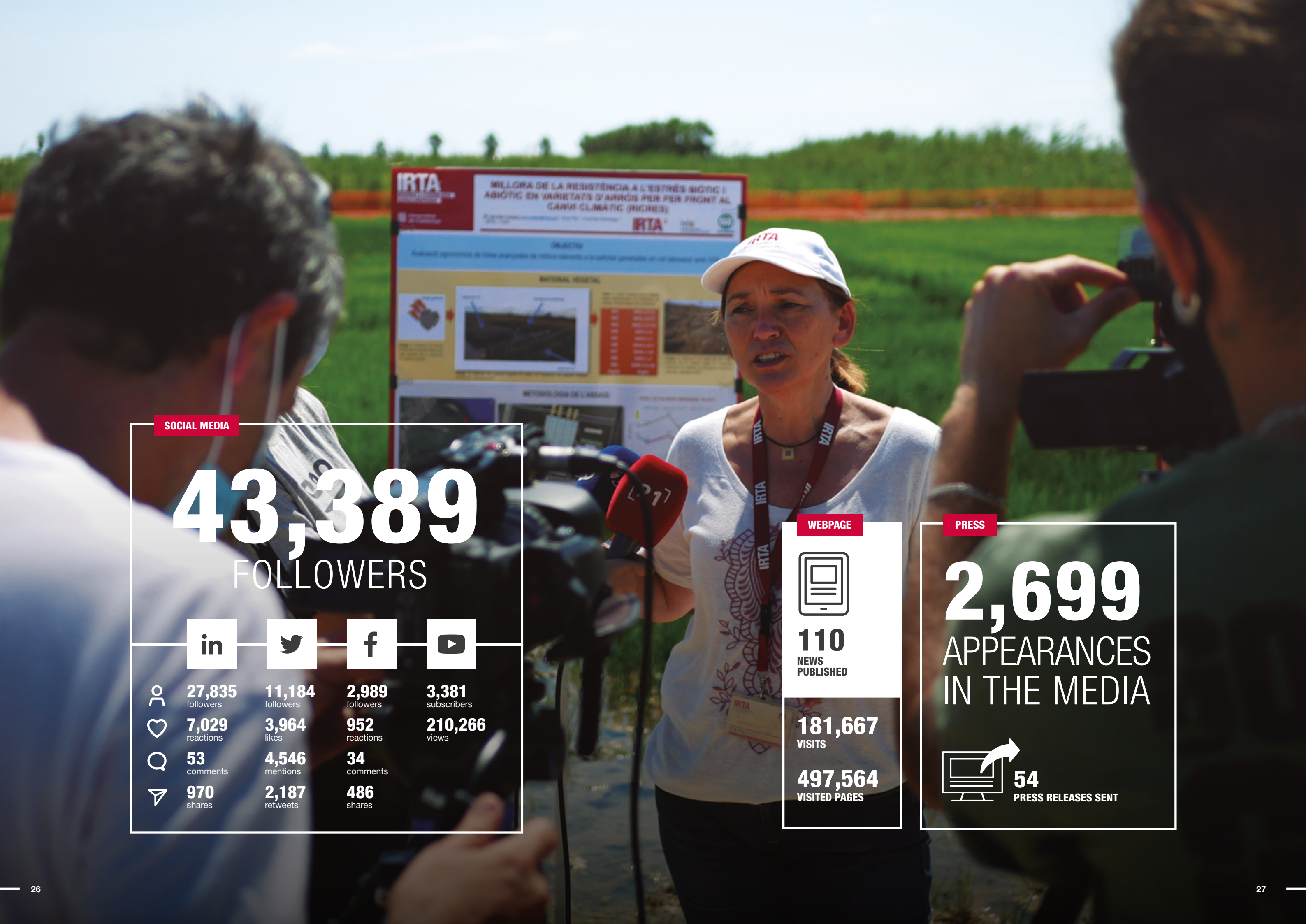
A summer camp to teach young people more about science and food

Researchers from the Genomics and Biotechnology programme at the CRAG, Iban Eduardo and Marta Pujol, together with the Post-harvest researcher Gemma Echeverría, took part in the first edition of the Catalunya La Pedrera Foundation's Science and Food Camp, which was held from 27 June to 3 July at Món Sant Benet. Eduardo and Pujol spoke about domestication in agriculture, the molecular basis of inheritance and genetic enhancement, while Echeverría focused on sensory analysis as a tool for improving product quality.

The Campus is aimed at students in their first year of secondary education and aims to highlight the importance of science in food innovation and research, as well as to encourage scientific vocations.

In addition to IRTA and CRAG, the University of Barcelona, Hospital Clínic and Fundació Alícia also contributed to the Camp.





SOCIAL MEDIA

43,389
FOLLOWERS



27,835
followers



7,029
reactions



53
comments



970
shares



11,184
followers

3,964
likes

4,546
mentions

2,187
retweets



2,989
followers

952
reactions

34
comments

486
shares



3,381
subscribers

210,266
views

WEBPAGE



110
NEWS
PUBLISHED

181,667
VISITS

497,564
VISITED PAGES

PRESS

2,699
APPEARANCES
IN THE MEDIA



54
PRESS RELEASES SENT

10

IRTA-OWNED CENTRES

BARCELONA

- 1 Torre Marimon
- 2 CReSA
- 3 Cabrls

TARRAGONA

- 4 Mas Bové
- 5 La Ràpita
- 6 Amposta

LLEIDA

- 7 Fruitcentre
- 8 Agrònoms

GIRONA

- 9 Monells
- 10 Mas Badia

2

PARTNER CENTRES

BARCELONA

- 1 Centre for Research in Agricultural Genomics (CRAG)
- 2 Centre for Agro-food Economics and Development (CREDA)

8

EXPERIMENTAL SITES AND FARMS

TARRAGONA

- 1 Valls Experimental Farm
- 2 Gandesa Experimental Site

LLEIDA

- 3 Les Borges Blanques Experimental Site
- 4 Mollerussa Experimental Site
- 5 Gimènells Experimental Farm
- 6 Alcarràs Experimental Site

GIRONA

- 7 Monells Cattle Farm (EVAM)
- 8 Pig Control and Evaluation Centre



OUR
CENTRES

IRTA^R

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