



NEIKER

MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

**RESEARCH AND INNOVATIVE
SOLUTIONS FOR THE AGRO-FOOD
AND FORESTRY SECTOR**

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2022 REEPORT

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1 INTRODUCTION

“

NEIKER, a benchmark agent for the sector, has promoted the agritech roadmap for the Basque Country together with other relevant entities”



In 2022, NEIKER technology centre has continued to help the agri-food and forestry sector so that it can face the enormous challenges that we already have before us with guarantees.

Among all of them, I would highlight the need for the sector to transform and move towards more productive, sustainable and resistant systems to the effects of climate change, and part of the responses to these challenges lies in what we call agritech. We know that the use of technology and technological innovation improves the efficiency and performance of agricultural and livestock processes, helps mitigate the impact of climate change and saves time, effort and money.

At European level, agritech contributes to the achievement of two priority objectives for the European Union, namely adaptation to climate change and climate neutrality in the sector, included in the European Green Pact and the 'Farm to Fork' strategy. In the Basque Country, it enables more sustainable production in

line with the agri-food policies promoted by the Basque Government. I am referring to the Plan for the Promotion of Organic Farming (FOPE), the Strategic Plan for Gastronomy and Food (PEGA) and the Strategic Plan for Wood (PEMA).

In 2022, NEIKER, a benchmark agent for the sector, has promoted the agritech roadmap for the Basque Country together with other relevant entities. Based on the needs expressed by professionals in the sector, NEIKER has worked to create the necessary R&D&I alliances to generate the optimum public-private ecosystem to boost the development and implementation of agritech in the Basque Country.

Some of the areas on which NEIKER has focused in 2022 have been the identification and implementation of key technologies for the sector, the promotion of local agritech entrepreneurship and training and support for technicians and the sector to incorporate these technologies into their daily work.

President of NEIKER
Bittor Oroz

“
With our new strategic plan we define where we want to be and where we must be in the coming years”



NEIKER Board of Administrators

Chair	Bittor Oroz Izagirre Vice-Minister of Agriculture, Fish, and Agro-Food Policy of the Basque Country.
Director General	Leire Baraňano Orbe
Secretary, non-Board member	Sonia Masip Moriarty Legal responsible at NEIKER
Members	<p>Iñaki Aldekogaraia Labaka Service Director at the Ministry of Economic Development, Sustainability, and the Environment of the Basque Government</p> <p>Raúl Perez Iracheta Quality and Food Industries Director at the Ministry of Economic Development, Sustainability, and the Environment of the Basque Government</p> <p>Jorge Garbisu Buesa Agriculture and Livestock Director at the Ministry of Economic Development, Sustainability, and the Environment of the Basque Government</p> <p>Xabier Patxi Arrieta Director of Information Technologies and Communication at the Ministry of Public Governance and Self-Governance of the Basque Government</p> <p>Federico Saiz Alonso Chair of BaskEgur</p> <p>Unai Ibarzabal Goikoetxea Director of Harakai-Urkaiko.</p> <p>Alaitz Ortuondo Pérez Aberekin, S.A.</p> <p>Nerea Múgica Herrán Technical Director of Garlan S. Cooperativa</p> <p>Ana Diez Navajas Representative of the workers at NEIKER</p>

2022 has been a year of reflection for NEIKER, culminating in the preparation of our Strategic Plan 2023–2026 and the Science, Technology and Innovation Plan 2023–2026. We have also led the implementation of the Basque Government's Agritech Roadmap.

With our new strategic plan we define where we want to be and where we must be in the coming years, both from a scientific-technical and management point of view. At the same time, we have drawn up the NEIKER Science, Technology and Innovation Plan 2023–2026, to respond to the major challenges related to the trends, policies and regulations that will mark the evolution of the agri-food and forestry sector.

In addition, in 2022 we have boosted the agritech roadmap to incorporate high technology into the sector and improve its competitiveness. Some of the solutions we have worked on include artificial intelligence to adjust the doses of phytosanitary treatments, BIG DATA to determine the quality of grapes before harvesting, vertical greenhouses or indoor

farming and precision livestock farming. We have also continued to help the sector mitigate the impact of climate change and adapt to its consequences. We have seen, for example, how green roofs maintain wine quality and regenerative grazing increases carbon storage in the soil, and we have planted the first high-yield pines in a forest, obtained through biotechnology, to assess their resistance to high temperatures and water scarcity.

Finally, proximity to the sector is part of our DNA, which is why we are organising around twenty transfer events in 2022. I would like to highlight the relevance of the one health meeting to reflect on the link between animal, human and environmental health, which is closer than we think. These events allow us to take the pulse of the sector and learn first-hand about its concerns, so that we can continue to innovate and develop products and solutions that are adapted to its real needs.

Thank you for continuing to collaborate with NEIKER for another year!

General director of NEIKER
Leire Baraňano

ABOUT NEIKER

2



About us...

We are a technology centre specialising in the creation of innovative solutions for the agri-food and forestry sectors. As an entity dependent upon the Basque Government Ministry of Economic Development, Sustainability, and the Environment, at NEIKER we work to bring knowledge and value to said sectors.

We are part of the Basque Research and Technology Alliance (BRTA), a Basque Government consortium that brings together different technological agents in the Basque Country to tackle industrial challenges in the Basque Country and compete with large leading international research and technology-development corporations.

Moreover, we are part of the Basque Network of Science, Technology, and Innovation, which groups scientific and technological bodies and entities. Working as a network enables us to conduct a balanced R&D&i activity, aimed at improving the productivity and competitiveness of the Basque Country's agricultural production systems.

...and what we do



We develop new technologies to improve profitability and management of farms, with a special focus on agri-tech, in order to meet the quality and safety requirements of the agri-food industry and the end consumer.

We create scientific knowledge and transferable solutions that contribute wealth and well-being to our society and surroundings.

We contribute to the development of an agro-food and forestry sector in the Basque Country, the preservation and sustainability of our agrarian and natural environment and developing policies that drive the circular bioeconomy in the Basque Country.



Plant research

- Production systems and good agricultural practices.
- Plant genetic improvement and indicators for resistance to diseases and ailments.
- Alternative crops and biomolecules of agri-food interest.
- Epidemiology and plant crop infection control.
- Diagnosis and detection of plagues and plant diseases.
- Precision agriculture.



Environmental research

- Conservation and sustainable use of agricultural and natural resources.
- Recovery of degraded soils.
- Environmental monitoring.
- Impact, mitigation, and adaptation to climate change.
- Greenhouse gas emissions in agro-livestock systems.
- Circular bioeconomy.

Animal research

- Genetic improvement.
- Food and nutrition.
- Production systems.
- Applied ethology and welfare.
- Epidemiological diagnoses, control, and observance of animal diseases.
- Zoonosis and food safety.
- Environmental biosafety, wildlife, and vectors as sources of infection for production livestock and people.



Forestry research

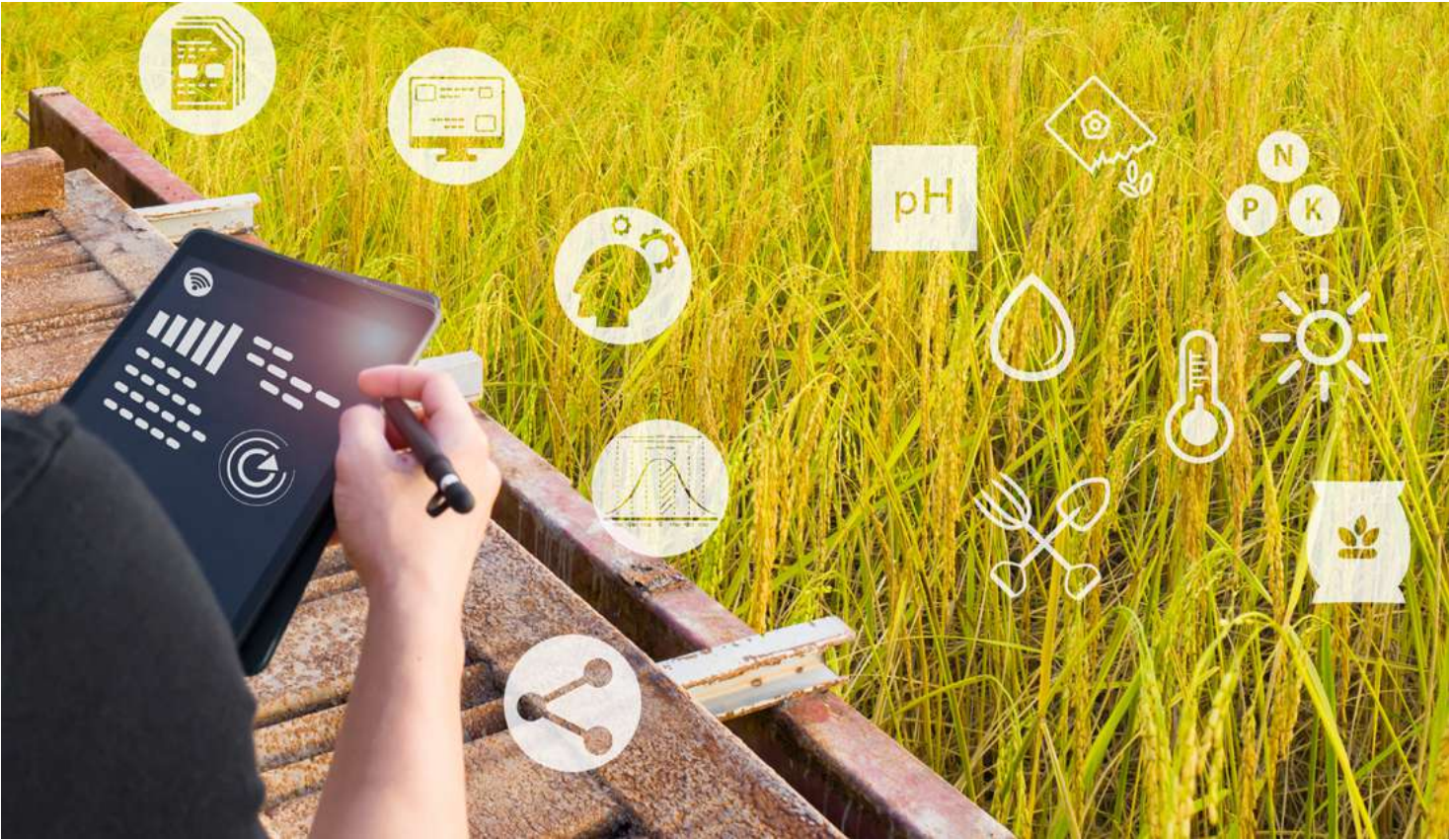
- Plant physiology and tissue culture.
- Genomics.
- Forestry pathology.
- Sustainability and ecosystem services.
- Genetic improvement.



Contribution to Sustainable Development Goals

→ The United Nations' Sustainable Development Goals 2050 (SDGs) are a set of global measures launched in 2015 to eradicate poverty, protect the planet and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific objectives that must be reached over the next 15 years. Each and every one of us must play our own role in reaching these goals.

NEIKER'S contribution falls in line with SDGs 3, 5, 12, 13, and 15: we work to guarantee a healthy life and promote well-being at all ages (3), achieve gender equality and empower all women and girls as one of the essential basics to build a peaceful, prosperous, and sustainable world (5), promoting sustainable consumption and production modalities (12), adopting urgent measures to fight the climate crisis (13), and sustainably managing forests, fighting against desertification, stopping and inverting soil degradation, and stopping the loss of biodiversity (15).



Helping the farming sector



We contribute to the competitiveness and sustainability of the agro-livestock and forestry sector through research and applied science.

Agritech

→ We incorporate high tech solutions into the farming sector to help it to transform and move toward more productive, sustainable systems that are resilient to the effects of climate change.

Sustainability

→ We promote sustainable and environmentally respectful production processes. We defend farming activity and share its contribution to preserving biodiversity, mitigating climate change, and maintaining the landscape.

Competitiveness

→ We use cutting-edge technologies and new production systems to increase profitability, competitiveness, and sustainability for operations, guaranteeing their continuity.

Climate change

→ We predict future scenarios and seek possible channels to mitigate and adapt to climate change, suggesting alternatives to current production systems. We inventory greenhouse gases emitted by the livestock sector.

Genetic improvement

→ We obtain more competitive products that are more focused on industry and consumer needs, better adapted to climate change and with a reduced environmental impact through genetic improvement.

One Health

→ We study the relationship between animal, human, and environmental health. We attempt to reduce the effect of zoonotic diseases and seek alternatives to rationalise application of plant protection products in agriculture and reduce the use of antibiotics with livestock.

Ecological production

→ We research and generate objective and scientific knowledge that helps to foment and strengthen this type of agriculture, making it compatible with the sector's competitiveness.

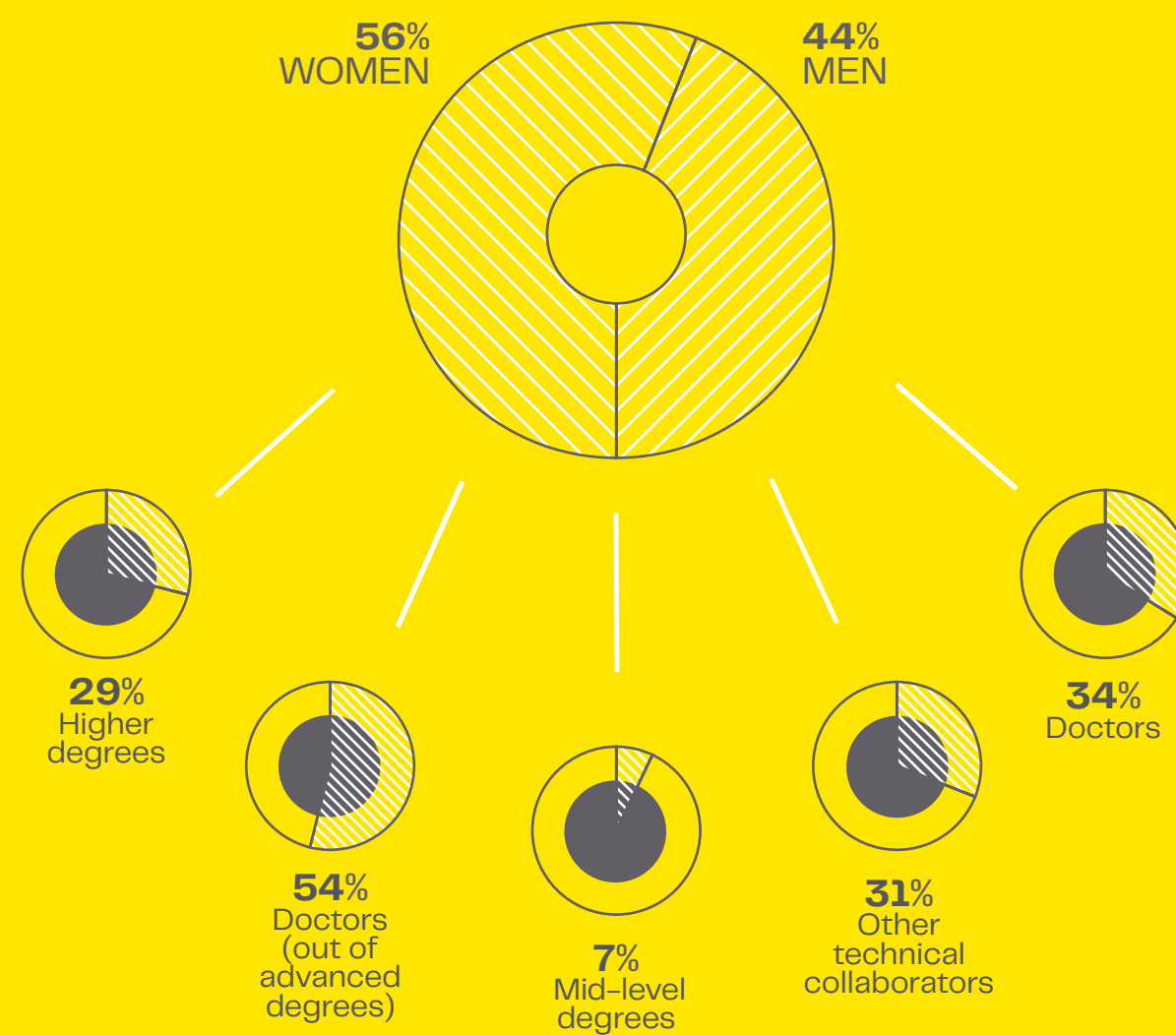
Circular bioeconomy

→ Production processes should not generate waste. Reducing and converting this waste into materials for new products is a way for us to fight climate change, reduce dependency on raw materials, and create new economic activities.

3 NEIKER'S TEAM



189 professionals ↓





Focused on internal, external clients and offering solutions

We seek solutions both internally and externally, creating value

Efficiency and excellency

We efficiently generate knowledge and advanced solutions

Sustainability and innovation

In all scopes of work with an advanced-management model based on processes and promoting ongoing improvement.



Welfare and development of people

→ We create opportunities for development for all people in safe environments that help their welfare.

Achievement-oriented

→ Promoting transfer, dissemination, and ongoing improvement for companies and society.

Ethical commitment

→ We act by following the principles of neutrality, devotion to public service, impartiality, transparency, honesty, and equality.

4 SCIENTIFIC AND MANAGEMENT EXCELLENCE

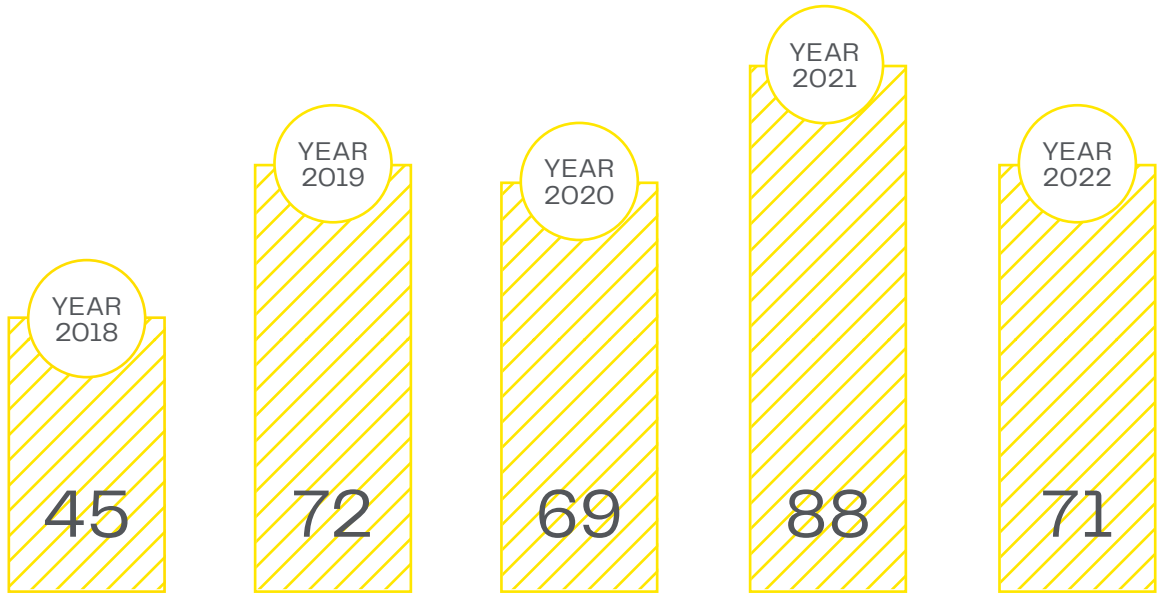


Following the guidelines of the Red Vasca de Ciencia, Tecnología e Innovación (Basque Network of Science, Technology, and Innovation, RVCTI), the main lines stemming from the European Union's Green Deal to facilitate incorporation of R+D+i into companies' strategies, so they can confidently tackle the three-fold technological-digital, energy-climate, and social-healthcare transition as a result of the impact of global megatrends.

4

Publications

No. of scientific publications indexed ↓



Patents

→ The European paratuberculosis patent (EP20382291.1) that we presented in 2020 is now in the final evaluation phase. NEIKER developed it to diagnose bovines infected with microbacteria. Its main contribution is that it provides early diagnosis of paratuberculosis and has medical and veterinarian applications. ●



Registration of new genetically improved varieties



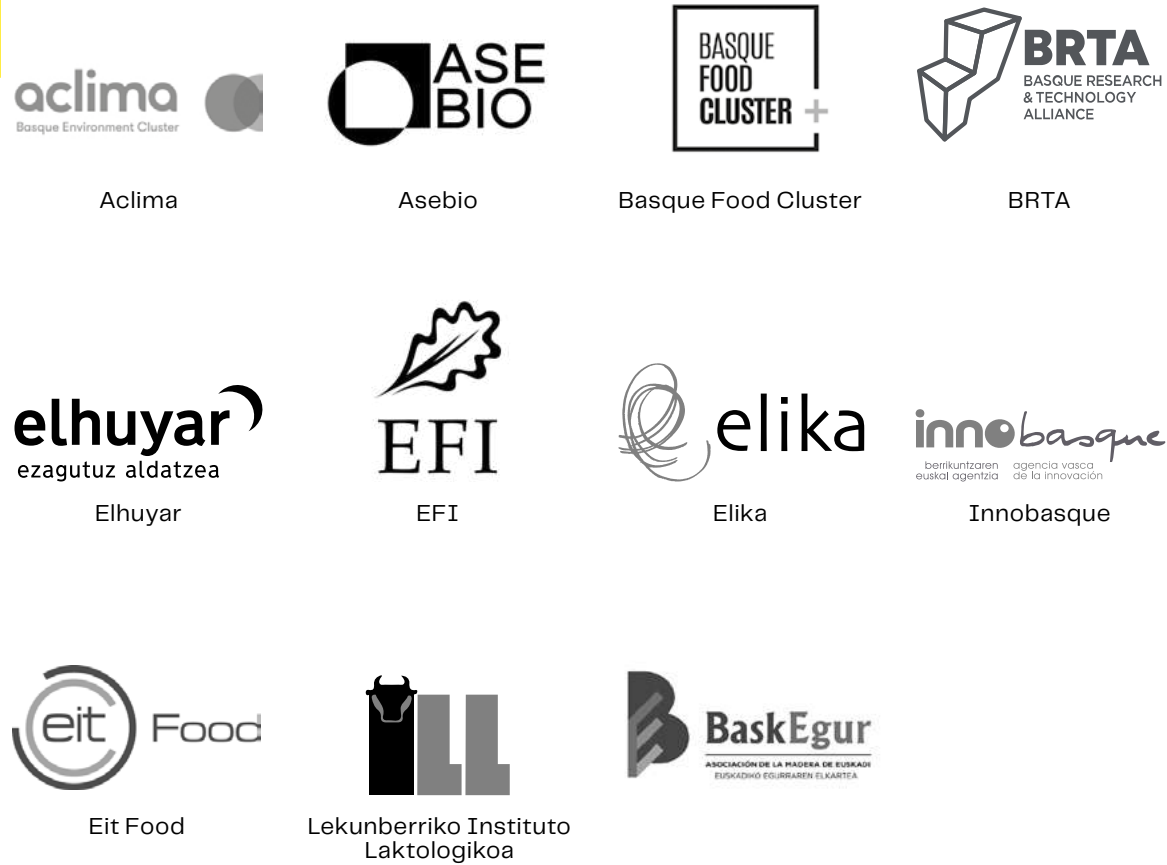
Argazkia: www.tolosa.eus

→ In 2022, we registered a new horticultural variety with the Registry of Protected Varieties, the Ibarako chili - Ibarako piparrak "IRRIBARRA," which we genetically improved to make it resistant to Tobamovirus, all while maintaining the original sensitive variety's good productive and quality features. This virus group is easily transmitted via contact and seed and has a heavy impact on harvests.

Diseases caused by viruses are responsible for decreased production and high economic losses. At NEIKER, we work on obtaining plant species that are resistant to different viruses by means of genetic improvement, since this is the only effective way to fight them, in combination with preventive hygienic practises in cultivation techniques.

Moreover, in 2022, the Registry of Protected Varieties granted definitive registration of the Gernikako bean - Gernikako indaba "PINTARKA," which will be extended until 2047 and which is known for a bit longer plant cycle but also a larger bean size. "PINTARKA" meets the needs of the sector, which demands varieties with greater yield and that are better adapted. This is why NEIKER has started up selection and homogenisation programmes. ●

4 Members of



Alliances




































Collaborations

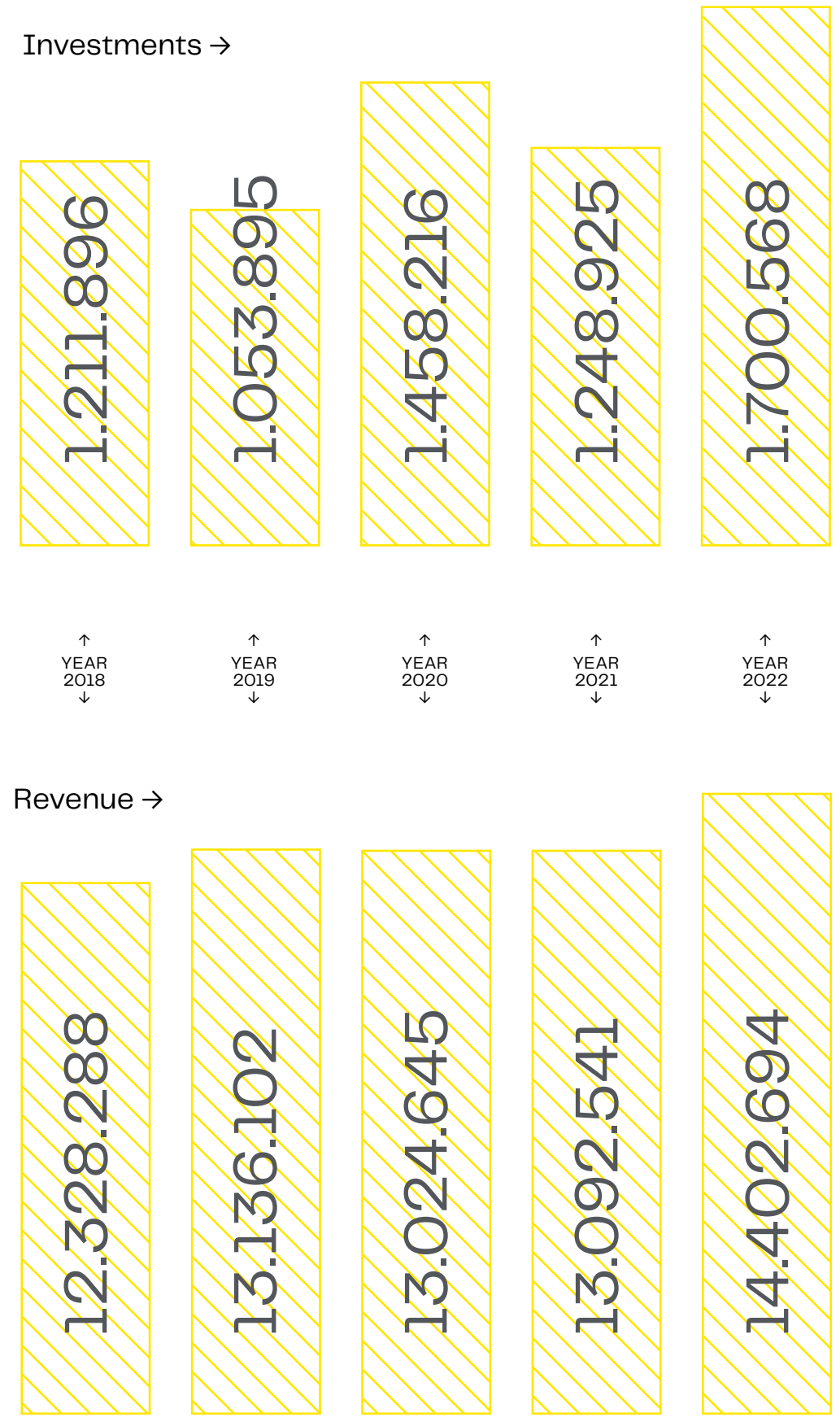


- With **IHOBE**, to establish lines of work to mitigate and adapt the farming sector to climate change and to preserve soil. ●
- With **BC3**, to define future lines of work to create knowledge to guarantee a primary sector resilient to climate change in the Basque Country. ●
- With **UDAPA** to conduct market tests, farmer acceptance, and commercialisation of potato varieties BELTZA and EDURNE. ●
- With **MEDCANN**, to characterise varieties of medicinal cannabis after obtaining authorisation from the Spanish Agency of Medications and Health Products. ●
- With **BIOBIZZ**, **AVANZA-BIO**, **GARAIA**, and **BARRENETXE**, to create new products and develop new cultivation techniques, like organic hydroponics fertilisation (bioponics). ●
- With **EITFOOD** and **LURSARE**, to drive and spread regenerative agriculture because it helps to protect soil and mitigate climate change. ●
- With **GARLAN**, to promote implementation of technification-digitisation in farming (AGRI-TECH). ●

4 Main clients

 <p>Aberekin</p>	 <p>ABRA</p>	 <p>Agromillora</p>	 <p>AEA Technology</p>	 <p>Alavesa de patatas</p>
 <p>Barrenetxe</p>	 <p>BASF</p>	 <p>BaskEgur</p>	 <p>BATURA MOBILE SOLUTIONS S.L</p>	 <p>BIOBIZZ</p>
 <p>Boehringer</p>	 <p>Bodegas Itsasmendi</p>	 <p>CERTIS</p>	 <p>Econatur</p>	 <p>ENKOA System S.L</p>
 <p>Egoín</p>	 <p>Garlan</p>	 <p>GARAIA</p>	 <p>Harakai-Urkaiko</p>	 <p>IK-Ingenieria</p>
 <p>InsektLabel</p>	 <p>IRTA</p>	 <p>Kaiku Coop.</p>	 <p>Medcann</p>	 <p>MIBA S.COOP</p>
 <p>Pascual</p>	 <p>Syva</p>	 <p>Timac Agro</p>	 <p>UAGA (Unión Agroganadera de Álava)</p>	 <p>Udapa</p>
 <p>UPL-Iberia</p>	 <p>UPV/EHU</p>	 <p>USSE</p>		

Financial-economic indicators



4 Ethics and equality

→ We are committed to being an organisation governed by ethical commitment and promoting people's welfare and development. The result of this is updating "NEIKER'S Code of Ethics" in 2022 and approval of NEIKER'S III Equality Plan. ●



LEADING FACILITIES AND ANALYTICAL SERVICES





In 2022, over 80,000 analyses ●

Over 25 years providing specialised consulting services for the agro-livestock and forestry sector ●

We have a team with over 20 professionals ●

Our analytics

- Animal health: reproductive and viral diseases in ruminants, microbacteriosis, microbiology for feed and raw materials, detection of pathogens in milk, antibiotic resistance, etc.
- Preservation of natural resources: fertility and hydric properties of soil, physiological and biological parameters of soil, consulting for transition toward agro-ecology, consulting on mitigating climate change, etc.
- Plant health: certification for seed and ware potatoes; purity trials and botanical seed germination, detection of quarantine organisms, disease diagnosis, identification of plant species variety, issuance of plant passport for proprietary propagating material...

Accreditations

We have 12 accredited techniques in:

- Microbiology-immunology areas.
- Molecular area.
- Biotechnology area.
- Plant health area.

Laboratory infrastructures and greenhouses

- Microbiology and immunology laboratory.
- Pathological anatomy, clinical biopathology, and parasitology areas.
- Level-3 biocontainment laboratory (NCB-3).
- Facilities for animal experimentation with levels 2 and 3 of biocontainment.
- Soil and plant matter analysis laboratory.
- Plant analysis laboratory.
- Biological contingency-2 greenhouse for trails with SL-2 quarantine pathogens.
- Greenhouses for hydroponic and aeroponic growing of plants and microalgae.
- Chromatography area.
- Biotechnology areas.
- Analytical chemistry area.

**OVER
300 CLIENTS**
from all links
on the chain
of value

**MEMBERS OF
THE NETWORK
OF BIOLOGICAL
ALERT
LABORATORIES
(RE-LAB)**

5 Leading facilities



High-security facilities

1.520 m²

673 m²
NCB-3 laboratory

845 m²
NCB-2 and SL-3 greenhouses

Laboratories

3.305 m²

705 m²
Laboratories for Conservation
of Natural Resources

1.100 m²
Animal Health laboratories

1.500 m²
Plant Health laboratories

Greenhouses and tunnels

7.138 m²

3.500 m²
Glass, plastic, and rigid
plate-covered greenhouses

2.000 m²
Test culture surface

1.638 m²
NBC-1 and aeroponics greenhouses

Livestock facilities

2.765 m²

Experimental farms for arable and fruit crops

100 ha

Other facilities

1.810 m²

900 m²
Warehouses, selection rooms and
characterisation and services

500 m²
Agriculture warehouse

340 m²
Field workshops

70 m²
Refrigeration chambers

6 2022 A YEAR OF IMPORTANT STRATEGIC REFLECTIONS



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2022 was a year of intense reflections at NEIKER, ending with preparation of our 2023–2026 Strategic Plan and the 2023–2026 Science, Technology, and Innovation Plan. We also led start-up of the Basque Government's Agritech Roadmap.

2023–2026 Strategic plan

Our new strategic plan is to continue the plans we have been developing since 2006. On this occasion, we began work in 2021 by identifying the great challenges in the sector and our society, and in 2022, we completed the process with participation and internal and external consultations, bringing all key input points together to develop the plan.

NEIKER'S 2023–2026 Strategic Plan defines where we want to be in the upcoming years, with a clear concept of where we began and by planning the actions that will allow us to successfully reach this horizon, both from a scientific–technical and from a management point of view.

2023-2026 Strategic plan

CHALLENGE 1

→ **Strengthening science and technology in the search for high-impact solutions**

- Providing solutions to the challenges of the sector and the concerns of society.
- Improving our scientific and technological production.
- Strengthening our current strategic alliances and collaborations and creating new ones.
- Consolidating the generation and dissemination of NEIKER's scientific knowledge.
- With our new Science, Technology and Innovation Plan 2023-2026.

CHALLENGE 4

→ **Consolidating NEIKER's digital transformation**

- Implementing digital technologies and ecosystems to provide greater value to our clients, partners and collaborators.
- Digitalising our internal processes to increase agility and efficiency.
- Migrating to a hybrid environment that combines the advantages of cloud storage with physical servers
- Renewing infrastructures and creating our own communication lines for NEIKER
- Updating the cybersecurity system and defining the confidentiality and information security policy.

CHALLENGE 2

→ **To be a benchmark in innovation and transformation in order to boost the profitability and sustainability of agri-food businesses**

- Transferring our knowledge to their production processes.
- Identifying new value chains in which to apply our expertise.
- Contributing to entrepreneurship and intra-entrepreneurship, generating new business models.
- Training our teams in innovation and asset transfer.
- Researching and following sector trends in the Basque Country, Spain and Europe.

CHALLENGE 5

→ **Contributing to the integral development of the people that make up NEIKER**

- Putting people's wellbeing at the heart of the company.
- Drawing up NEIKER's functional map to respond to our internal and external needs.
- Promoting the professional career of our researchers and adapting it to the requirements of the environment (RVCT, HRS4R...).
- Promoting conversational competences that allow us to advance in the listening and professional development of people.
- Fostering motivation and the feeling of belonging to NEIKER.

CHALLENGE 3

→ **Strengthening the NEIKER brand to become more and better known nationally and internationally.**

- Updating our dissemination tools, paying special attention to new formats and ways to communicate.
- Positioning ourselves as a technology centre that provides solutions to citizens' concerns: food, health and wellbeing and climate change.
- Generating specific actions for NEIKER's different interest groups, including international ones.
- Organising transfer events to share knowledge and gather needs.
- Participating in national and international forums on our lines of action.
- Bringing science closer to the public, taking part in scientific dissemination actions.

CHALLENGE 6

→ **Committing to an innovative and sustainable business model**

- With sustainability plans that contribute to minimising our energy and environmental impact.
- Optimising our Occupational Health and Safety System
- Exercising responsible, ethical and transparent governance, guided by our code of ethics.
- Integrating equality as a strategic axis in NEIKER's management and executing our IV Equality Plan.
- Favouring the standardisation of the Basque language internally and externally, as a work and communication tool.

2023-2026 Science, Technology and Innovation Plan



→ At the same time, we prepared NEIKER'S 2023–2026 Science, Technology, and Innovation Plan to meet the great challenges related to trends, policies, and standards that will mark the evolution of the agro–food and forestry sector.

It was prepared by NEIKER'S researchers, who have solid experience in research, driven by their desire to contribute to challenges in the primary sector and, particularly, to the transitions this sector will require to increase its competitiveness and sustainability (ecological transition, digital transition, technological transition, social transition).

Agro-tech →

- Medium–high–tech indoor farming. ●
- Smart livestock and agriculture for sustainable and efficient production. ●
- Agrovoltatics. ●

Agro-sustai-nability →

- Healthy soils. ●
- Early pest detection and treatment. ●
- Forest resilience: production, biodiversity, and other services. ●
- Biodiversity. ●

Agro-health →

- One Health. ●

Circular bioeconomy →

- Biofactories. ●
- Reuse of sub-products. ●

Agro-social →

- Reuse of sub-products. ●

In 2022, we worked on the Basque Country's Agritech road map.

Its objectives:

- To improve competitiveness, efficiency, and the current environmental impact of the sector by implementing key technologies. ●
- To increase food production to reduce dependency. ●
- To increase training, both in Vocational Educational Training and the university, in technified livestock management and agriculture. ●
- To promote local agritech entrepreneurship. ●
- To create new business opportunities for the Basque Country's industrial fabric, for those who wish to diversify their supply toward the worldwide agro-food chain (sensors, components, robotics, materials, structure, energy field, etc.). ●
- To draw foreign investments to the region (production and/or technological). ●
- To draw startups that require incubation or acceleration (production and/or technological) for later implementation. ●
- To create an optimum ecosystem within the Red Vasca de Ciencia, Tecnología e Innovación (Basque Network of Science, Technology, and Innovation) to tackle agritech challenges (R+D+i agents and instruments). ●
- To create an optimum public-private ecosystem to boost development and implementation of the road map. ●

The first steps from this road map were taken in 2022 with projects focused on precision agriculture with fertiliser and irrigation systems based on artificial intelligence, aeroponic seed potato production, protected growing systems like greenhouses or indoor farming, precision livestock, and agrivoltaics, to name just a few.



2022 RESEARCH AND TRANSFER



#agritech



Artificial intelligence to improve irrigation

The combined use of decision support tools and app development optimises consumable supply dosage (fertilisers, plant protection products, and water), which is one of the European Union's "Farm to Fork Strategy's" objectives to make food systems fairer, healthier, and more environmentally respectful. In 2022, we improved and adjusted the URA application (available on NEIKER'S website) to calculate irrigation dosage needs for arable crops. This tool to predict irrigation dosage maximises water use and agriculturalists can apply it directly and easily and adapted to the conditions of each particular plot of land. In 2023, we will extend this app to the Basque Country's fruit crops.



BIG DATA and grape quality

We put Big Data at the service of wineries to determine the quality of grapes before harvest. The CLIMACAL tool is based on predictive models that help wineries to adapt their wine-making strategies, from harvest planning (date, selected harvest, grape destination depending on wine type) to designing products and processes (logistics, purchases, sales, etc.), as well as planning future actions and management, both in the field and in the winery.



Cutting-edge microscopes to capture microbe movement

We have developed a soil. For the first time, it can capture the movement of microbes under the soil around the roots of growing plants, which provides better understanding of the interaction between plant roots and soil microbes. This aspect is essential to achieving more sustainable farming production. One of the applications from the information obtained with this microscope is designing new strategies to improve crop fertilisation.



#sustainability + #competitiveness

Beltza and Edurne, our new potato varieties

We transferred the new Edurne and Beltza potato varieties to the UDAPA cooperative. The result of collaboration between NEIKER and UDAPA, these tubers are palpable proof of how valuable alliances between technological centres and the agro-food sector are, since they allow us to find solutions to challenges and make the most of new opportunities that can arrive for the future. This is the first time that a potato license has been transferred to a Basque Country company that produces ware potatoes. Also of note is the fact that the packing label says that NEIKER is the breeder.



Nuts, an opportunity to diversify the sector

Our study on the viability of nuts as an alternative for crop diversification in the Basque Country continues. In our area, consumption of nuts is increasing by more than 5% per year. However, only 20% of the product consumed is local. For several years, NEIKER has been analysing the adaptation of walnut trees to our region, which varieties provide the best yield, and how profitable growing them could be. NEIKER'S trials are focused on Zambrana (Alava), and they are mainly being conducted on walnut trees, as well as almond and hazelnut trees. Specifically, as far as walnut trees are concerned, we studied a French and two Californian varieties, with a thinner shell and meatier fruit. Consumers highly value these characteristics. In 2022, we organised several tours of these plots to show progress with the crops and answer questions of farmers interested in diversifying their operations.



Health and nutrition solutions for the ovine sector

Under the EUROSHEEP project (European network to exchange sheep knowledge), in 2022, we compiled 54 tips and tricks to apply solutions designed to improve health and nutrition in sheep herds, based on needs identified at the beginning of the project. Moreover, 44 solutions (24 in health and 20 in nutrition) were tested and evaluated based on 144 surveys given to end users. Additionally, a cost-benefit analysis was conducted on said solutions, and on their impact on sustainability. Twenty-six factsheets were also written to provide solutions or responses to other needs raised by the sector. All this practical information and much more (solution sheets, technical documents, etc.) is available on the project's webpage (eurosheep.network).



First prototype of an oral vaccine for paratuberculosis

We developed the first oral vaccine to fight paratuberculosis in ruminants. This disease is a serious health and economic problem for livestock operations around the world. In addition to other advantages, this new administration method avoids interference with diagnosing bovine tuberculosis. This development is truly noteworthy, because current commercial vaccines designed for bovine livestock are only permitted in certain countries, since they interfere with diagnosing other diseases like tuberculosis. We have also observed another benefit to this vaccine: it stimulates the animal's immune system, making it more competent against other bacteria that affect livestock.



Bio-disinfection to control fusarium

We managed to reduce lettuce losses caused by fusarium by 40%. This fungus provokes huge losses to farming operations. We used a bio-disinfection strategy expressly developed at NEIKER.



#climate change

Plant covers to preserve wine quality

We tested new strategies to adapt vineyards to climate change and establish agronomic practises to improve their resistance. Under the European VITISAD project, this work verified that using plant covers can help to preserve the wine's quality and that delaying pruning can act as defence against spring freezes. We also studied practises to optimise irrigation water, the role of reducing the temperature of the grape cluster and controlling ripening. All these practises were tested at 30 pilot farms in commercial vineyards in Spain and France.



Regenerative grazing to mitigate climate change

We proved that regenerative grazing can mitigate climate change, all while improving soil fertility. In addition to other benefits, we verified that it increases carbon storage in the soil by 4%, thereby reducing the impact of climate change. Additionally, it improves soil fertility, increases the amount of grass produced, and reduces the carbon footprint, all without affecting milk production for sheep.

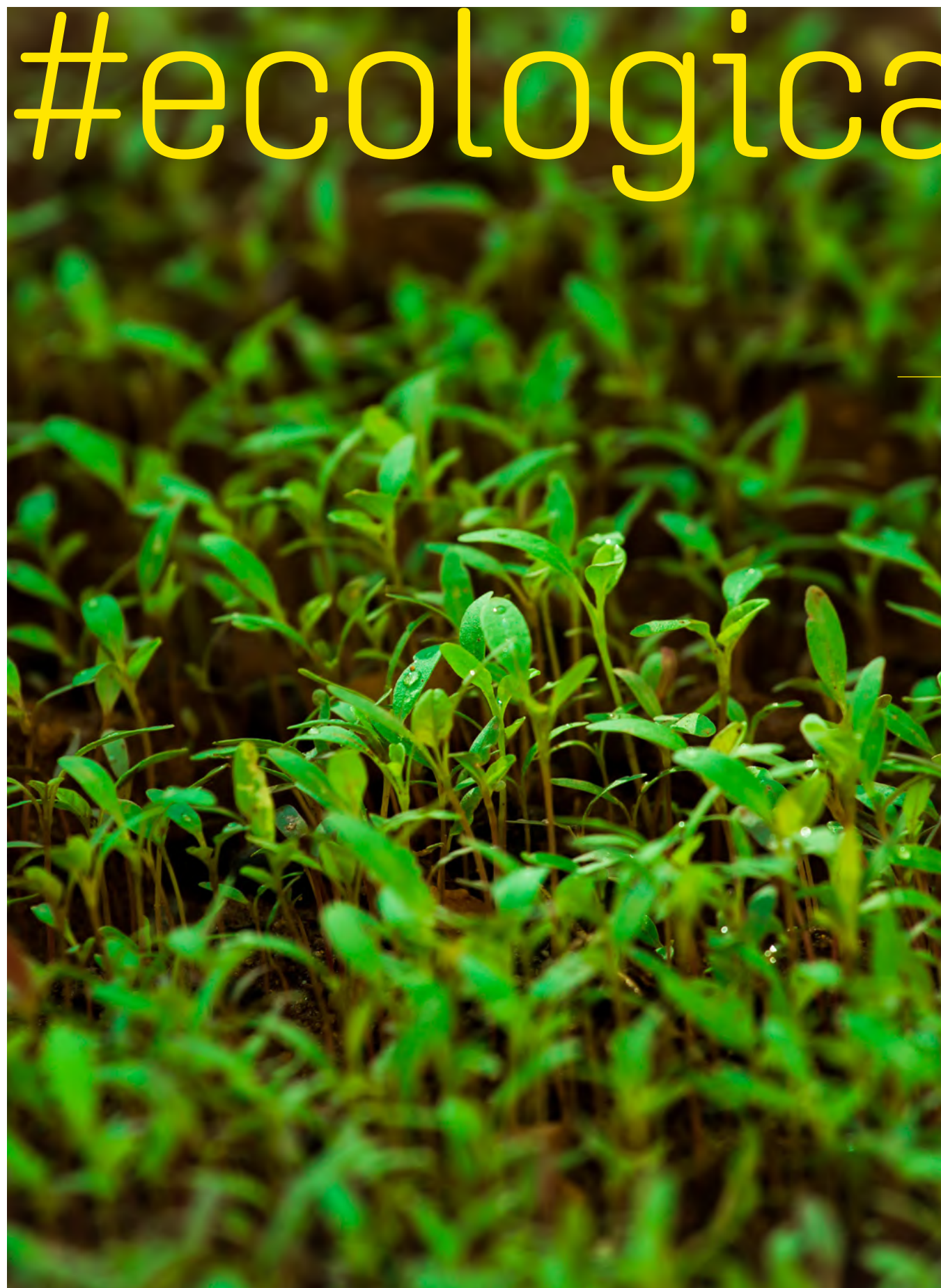


Pine trees adapted to global warming

In 2022, we established Europe's first plantation of radiata pine obtained via the somatic embryogenesis technique. This technology multiplies trees with the desired yield and that possess outstanding characteristics, like tolerance to high temperatures, water scarcity, or impoverished soil, in order to contend with climate change. We achieved this milestone under the MULTIFOREVER project to ensure the health of forests with climate change. The plantation, located in Llodio (Álava), has over 800 pines.



#ecological production



New varieties for ecological agriculture

In recent years, ecological production has continued to take over more hectares of land in the Basque Country. According to data from the Ministry for Agriculture and Ecological Food of the Basque Country (Ekolurra), in 2021, the surface area devoted to ecological cultivation grew by 16% in comparison with 2020 in the Basque Country.

For this kind of cultivation to continue expanding, research into new varieties that can contend with current challenges is essential. Within this context, in 2022, we held two field tours for agriculturalists interested in this sort of crop around the 8 hectares of our experimental trials in Arkaute (Álava). During these field outings, we presented our progress with grains like wheat and oats for flakes, and horticultural species like squash on paper mulch, red beetroot, sweet corn, and edamame. We also showed results from meadow phosphoric fertilisation trials that we conducted in collaboration with Fertinagro Biotech, a company specialised in biofertilisation.

This field work falls under the Plan para el Fomento de la Producción Ecológica (Plan to Promote Ecological Production) (FOPE), driven by the Basque Country and promoted by NEIKER and the Ministry of Agriculture and Ecological Food of the Basque Country (Ekolurra).



#bioeconomy

Biofertilisers from growing microalgae

Per year, the European fishing industry generates around 5.2 million tonnes of waste from processing ocean fish that contains highly valuable minerals that could be recovered and used for agricultural production. It is within this context that the European project SEA2LAND was born. Coordinated by NEIKER, 26 partners from 11 countries participate to convert waste from the canning industry into biofertiliser by growing microalgae. In 2022, we took our first steps in this regard and developed new fertilisers that include microalgae in their composition that come from waste from different tuna canning



We use grape stems as a food additive

Using sub-products from the food industry in circular economy processes is essential and will turn livestock production into a more sustainable system that meets the growing demand for products of animal origin, like meat, dairy, etc. For this reason, NEIKER is working on different projects where we will reuse sub-products from the farming sector as possible food additives for livestock. One of them is NEWFEED, where we design feed for ruminants (dairy cows and sheep) that include grape stems from wineries as one of their ingredients, using circular economy processes.



Insecticulture's circular chain of value

Around 70% of the protein used in the EU for animal feed is imported, which influences our search for alternative sources for greater protein self-sufficiency. The FAO not only approves insecticulture in Europe, but also considers it necessary for more sustainable development.

At NEIKER, we have been working on different insecticulture projects from some time with companies that strive in this direction. With InsectLabel, we work on two fronts: to use sub-products from the food industry to feed insects, in order to reduce the use of grains in making feed, and the use of insect excrement as fertiliser to reduce the environmental impact.

Results from analysing the life cycle show that the environmental impact of insect flour protein is considerably lower, thanks to using excrement as biofertiliser. Moreover, we have observed that, by adding lettuce and bread crumb sub-products to larva feed, the environmental impact of insect flour protein is reduced by 11%.



#onehealth

Bird flu monitoring

It is fundamental to monitor infections and/or illnesses in the natural environment that affect wild species and may be concerning for domestic livestock and humans. For this reason, NEIKER keeps surveillance over different viruses, bacteria, and parasites in different wild species.

In 2022, we learned the news that bird flu had been detected in wild birds, caused by the highly pathogenic H5N1 virus, which could lead to huge losses in the poultry sector. NEIKER is part of a surveillance group for bird flu in the Basque Country, created in 2006 along with the Basque Government, Erika Fundazioa, and the Provincial Councils of Alava, Biscay, and Gipuzkoa, in addition to the Basque poultry sector. The purpose of this surveillance is to detect the virus early in order to contain the disease in the event that sources emerge, and also to take the necessary measures to reinforce surveillance and increase biosafety at poultry farms. At NEIKER'S Animal Health laboratory, we conduct bird flu tests (in 2022, we detected 25 sources in the Basque Country), and along with the other aforementioned entities, we took part in developing informative materials and manuals on how to act in the event of suspicion.



Monitoring invasive mosquitos

Mosquitos are hugely relevant to human and animal health because they can transmit diseases. Since 2013 and in collaboration with the Basque Government's Ministry of Public Health, we have monitored the presence of the invasive *Aedes* mosquito in the Basque Country. The *Aedes albopictus* species was detected for the first time in 2014. Since then, the surveillance programme has evolved year after year, progressively increasing the number of municipalities studied, such that last year we sampled all cities with more than 10,000 inhabitants. In 2022, we found that they were present in 65% of the cities examined. Also identified, and for the first time, was another invasive species, *Aedes japonicus*, in several municipalities of the Basque Country. While *Aedes albopictus* is mainly found in urban areas, *Aedes japonicus* was found in peri-urban and rural zones.



#animal welfare



Practical guides to ensure welfare of pullets and laying hens

We published a collection of practical summaries on how to breed and manage pullets and laying hens to guarantee a high level of welfare during their transition to cage-free production systems. We conducted this work under the European "Best Practice Hens" project. The guides include examples of good practises and solutions for leading problems in egg production. They are valuable not only to egg producers and industries, but also to consultants, lawmakers, and organisations that work in the field of animal welfare.



Protocols to certify lamb welfare

In 2022, we designed and transferred a protocol to the sector to evaluate and certify welfare for milk lambs. One livestock operation that commercialises around 7,000 lambs per year has already been certified. Moreover, we made progress on designing and evaluating the goat protocol. Under the framework of the animal welfare certification WELFAIR, the protocols supervised by NEIKER are for turkeys (in 2022, 641 farms were certified) and for sheep, with 3 protocols: sheep in feedlots (74 operations certified), sheep (119 certified), and milk lambs. We have also trained 7 turkey auditors, 17 feedlot sheep auditors, and 19 milk lamb auditors on the different protocols.



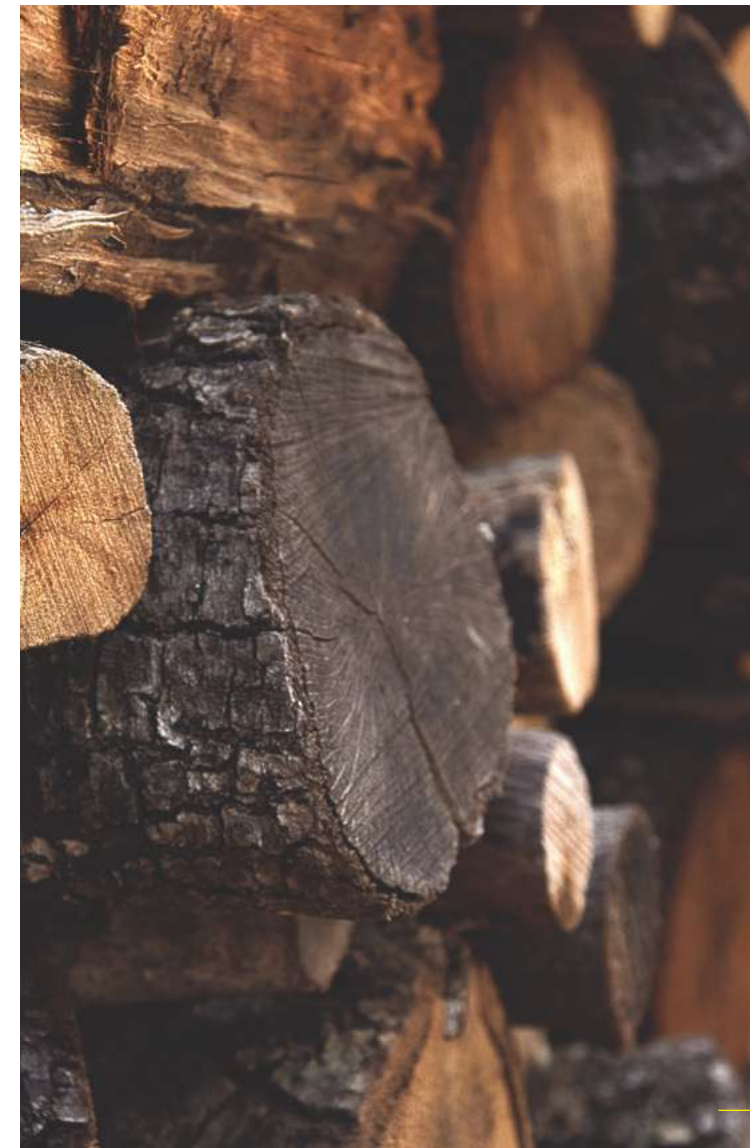
#forest improvement

Our activity falls under EUSKOBASOA 2050, the Basque Country's Plan for Forestry Improvement, which consists of four lines of action: health, alternative species, wood quality, and the reactivation of a genetic improvement plan.

Under health, last year, we continued to research alternatives to combat "banda marrón" and "banda roja" in the 2019–2022 Experimental Pilot Plan.

Forest soil and water quality

We studied water in the soil and vegetation in forests, and also suggested guidelines for forestry management in drainage basins, because the quality and quantity of the water we drink depends on this. In 2022, we monitored five basins planned for production of potable water with different forest cover (pine, eucalyptus, and beech). We collected a daily water sample at the collection point all year long in order to analyse different parameters that are fundamental for the purification process. These data helped us to identify the most sensitive period of the year for ensuring water quality, vital information to fulfil health criteria for the quality of water for human consumption set forth by Royal Decree 140/2003.



Quality and sustainable wood

We continued selecting trees with noteworthy characteristics all around the Basque Country region that can contend with future environmental conditions (set by climate change) in the most suitable manner and that provide quality raw materials for the forestry sector. We place emphasis on genetic diversity to ensure materials with the greatest resilience possible, and we completed a study on pine populations all along the Cantabrian coast. These "plus" trees were replicated at our facilities and are being established at plantations where they will act as a repository for valuable material for the entire forestry sector and to continue with genetic improvement, future trials, provision of quality seeds, and more.



#transfer days + #webinars

We share and transfer our knowledge, research, and solutions with the sector.



- Opportunities for nut trees
● [18 February](#) →→
- Sustainability practises for dairy operations ● [23 March](#) →→
- Sustainable strategies for adapting vineyards to climate change
● [24 and 25 May](#) →→
- Visit the first trial with radiata pine somatic plant in Europe ● [30 May](#) →→
- Solutions for professionals in the ovine sector, Eurosheep network
● [31 May](#) →→
- EcoWine2022 Symposium: "Vino ecológico: el futuro del sector (Ecological Wine: the Future of the Sector)" ● [1-3 June](#) →→

- Tour of evaluation trials of grain varieties 2021-2022 with the GENVCE network ● [15 June](#) →→
- Efficient nitrogen use in agriculture
● [22 June](#) →→
- 40 years of animal health campaigns that eradicate tuberculosis and ovine and bovine brucellosis in the Basque Country ● [29 June](#) →→
- Strategies to protect the soil from the impact of climate change
● [6 July](#) →→
- Animal welfare: label science
● [8 July](#) →→
- Tour of NEIKER's ecological agriculture plots ● [15 Jul](#) →→

- Diversification of crops in the Basque Country: the possibilities of hops and walnut trees ● [22 July](#) →→
- Tour of NEIKER's ecological agriculture plots ● [20 October](#) →→
- From animals to humans: transmissible diseases and One Health
● [29 November](#) →→
- Agritech, the response to challenges in the agro-livestock and forestry sector of the Basque Country
● [12 December](#) →→
- Mikrobiogune II: second meeting of microbiologists in the Basque Country
● [13 December](#) →→
- Big Data at the service of wineries to determine the quality of grapes
● [14 December](#) →→

**AVERAGE
SCORE
OF OUR
WORKSHOPS
→ 8,1**





Science dissemination

→ We participated in Zientzia Azoka, an initiative by Elhuyar Fundazioa to drive scientific culture through projects designed by youth. We were on the jury to select winning proposals and we welcomed participating schools for a two-day stay.

We also supported initiatives like Pint of Science to disseminate science in fun, personal talks and in formats that are more accessible to the public. Once again this year, in 2022 we were in Vitoria (beer in hand), chatting about the One Health concept, ecological wine, and how to recover nutrients through animal feed. ●

Basque



Support for Basque

With the "Neiker saria" award, we promote sharing science in Basque, under the framework of the CAF-Elhuyar awards. 2022 was the sixth edition, won by an article on smart labelling to avoid waste.

In addition, we have taken part in the 22nd edition of Korrika as it passed through our centres of Derio (Bizkaia) and Arkaute (Álava), as on previous occasions, and also in the third edition of Euskaraldia, an initiative that aims to get more people who understand Basque to encourage them to use it. ●

Solidarity



Solidarity



→ We continue to support the NGO Saluganda, created in 2010 to improve the quality of life of women, girls, and boys in rural areas of Uganda. Saluganda's lines of action are education, water and sanitation, agriculture and livestock, and health and nutrition.

And we have collaborated with Banco de Alimentos (Food Bank) since 2015, donating excess generated through our research activities to the entity. In 2022, we delivered 30,000 kilos of potatoes that helped over 1,200 families. ●

Equality



Equality

→ As an entity that believes in and works toward equality, last year we supported and participated in different initiatives to make our stance clear. These include STEAM Sare and International Day of Women and Girls in Science (11 February) which, through talks at school centres, raises visibility for the work that women do in STEM (Science, Technology, Engineering and Mathematics). ●

9 AWARDS AND RECOGNITIONS



9

5 of NEIKER'S researchers, among the 5,000 most prominent scientists in Spain

→ According to the ranking by the Consejo Superior de Investigaciones Científicas (Higher Council of Scientific Research) (CSIC), which only includes professionals with a profile in the Google Scholar database, five of NEIKER'S colleagues rank among the 5,000 most prominent scientists in Spain.

These scientists are specialist in animal welfare and applied ethology, Dr Inma Estévez, the soil conservation expert, Dr Lur Epelde, the waste recycling researching, Dr Miriam Pinto, the biochemist specialised in immunology, Dr Natalia Elguezabal, and the expert biologist in animal genetics, Dr Eva Ugarte.

NEIKER warmly welcomes the publication of this ranking, since it is recognition and showcases the role of women on the national scientific stage. ●



We are once again on Stanford's list of the best researchers in the world

→ Carlos Garbisu, scientific director of NEIKER and specialist in environmental microbiology, and Ramón Juste, expert in animal health, are in their fourth running year on the "World's Most Influential (Top 2%) Scientists" list, this time joined by Inma Estévez, a well-known scientist in animal welfare and ethology.

This recognition is especially well-deserved, considering the limited number of research staff that NEIKER has in comparison with other entities on the list.. ●

Eduardo Rosa, doctorate student at NEIKER, wins two awards with his thesis

→ Reducing nitrogen gas emissions at laying hen farms was the topic of the thesis he conducted at NEIKER, which won the Research Award 2022 from the Institute of Egg Studies and the RED REMEDIA 2022 prize for the best thesis on mitigating climate change in the agro-forestry sector. Congratulations, Eduardo! . ●



We obtained the BIKAIN certificate for Quality in Language Management

→ This seal, granted by the Basque Government, accredits standardisation of the Basque language within the organisation. This is a great recognition of the work we have been doing for decades on the road toward standardising Basque, both within the organisation as a work and communication tool, and outside NEIKER to drive investigation in the farming sector in Basque. ●

NEIKER

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