FEED-A-GENE

Adapting feed, animals and feeding techniques for more efficient and sustainable monogastric livestock production systems

Deliverable D7.8

5th annual newsletter and minutes of the two demonstration events and of the stakeholder meeting organised during the 5th year of the project

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Table of contents

1 Summary

This deliverable includes the 5th and final Annual newsletter and the minutes of two demonstration events and of the stakeholder meeting organised during the 5th year of the project. The annual Feed-a-Gene newsletter aims to inform stakeholders and consortium partners about recent, on-going, and planned events and activities, and about the progress made since the last meeting in May 2019. Progress reports were communicated by Work Package leaders during and after the 4th Feed-a-Gene annual meeting held in Budapest in May 2019. The newsletter was disseminated by email to 462 stakeholders and is available as a PDF file on the website. The minutes of the meetings were recorded and edited by AFZ.

2 Newsletter

2.1 Introduction

The impact of the Feed-a-Gene project depends heavily on the ability of its partners to disseminate information to stakeholders during all the phases of the project. The dissemination plan includes the publication of five annual newsletters. The objective of this final newsletter is 1) to present recent, on-going, and planned events activities related to Feed-a-Gene, 2) provide updates on the progress made in the project since the last annual meeting in May 2019, and 3) to make the project attractive to stakeholders, increase the target audience, and maximise the impact of the project.

2.2 Methodology

The newsletter was designed and edited by the AFZ team using texts and photographs provided by AFZ and the consortium partners.

2.3 Results

2.3.1 Delivery format

The 5th Feed-a-Gene newsletter is provided in three formats.

- As a printable PDF brochure in A4 format. The document is 12-page long, in colour and it uses the visual identity guidelines defined in Deliverable D7.1.
- As an email sent to stakeholders and partners with links to individual articles.
- As a page on the Feed-a-Gene website that links to individual articles.

The PDF and the page are available at http://www.feed-a-gene.eu/newsletter/feed-a-gene-newsletter-5.

The PDF is presented in the following pages:

Feed-a-Gene

Newsletter #5

March 2020

Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems

Editorial

Dear readers,

We are honoured to present the fifth newsletter of the Feed-a-Gene project funded through the Horizon 2020 programme of the European Union. As our project is now completed, this newsletter is dedicated to the final meeting held on 22-23 January in France. It presents the results shown during that conference and the discussions that took place between the partners and the stakeholders.

Feed-a-Gene has been a huge endeavour for all of those involved. More than 100 people from 23 organizations have been working together for 5 years, and we can all be proud of the work that has been accomplished. Feed-a-Gene results have been disseminated in 240 publications, including more than 30 peer-reviewed papers. They cover a wide range of technology readiness: some are opening new doors and their promises are exciting, others are at the prototype stage and are already implemented in the field.

Feed-a-Gene is now finished, but the research goes on, and it is up to the stakeholders to pick up these results and turn them into practical innovations that are profitable for the society and for the environment.

Jaap van Milgen (INRAE)
Feed-a-Gene project coordinator

The Feed-a-Gene Project has received funding from the European Union's H2020 Programme under grant agreement no 633531

Feed-a-Gene

Final Feed-a-Gene meeting

22-23 January, Rennes, France

The final meeting of the Feed-a-Gene project took place on 22-23 January at the Hotel de Rennes Métropole in Rennes, France.

It was organized by AFZ, the partner in charge of communication and dissemination.

MÉTROPOLE Rennes

Rennes Métropole is an intercommunal structure centred on the city of Rennes, in the Brittany region.

The final meeting of the Feed-a-Gene project took place in Rennes, France. This 2-day conference was open to all Feed-a-Gene stakeholders: it was attended by 146 people, half of them from organizations not in the original consortium. During the conference, Feed-a-Gene partners presented the results of the project, and stakeholders were able to provide feedbacks and ideas during the plenary sessions, demonstrations, poster presentations and workshops.

Project coordinator Jaap van Milgen and meeting organizers Valérie Heuzé and Gilles Tran would like to thank the staff of the Hôtel de Rennes Métropole who made this meeting possible and enjoyable.

The presentations, posters and videos are available on the Feed-a-Gene website.
CLICK HERE

Keynote speakers

Introduction

Isabelle Pellerin, vice-president of Rennes Métropole, introduced the conference by thanking the organizers for setting it up in Brittany, which is the first agricultural region of France.

"We need you"

In the first presentation of the plenary session, Jaap van Milgen gave the audience a brief overview of what the project did in the past five years: novel feeds for increasing protein autonomy in Europe; novel traits to observe variation; new traits and models for the genetic improvement of feed efficiency; new models of biological function for understanding and predicting animal response; precision feeding systems; a sustainability assessment of the solutions proposed by the project.

Jaap van Milgen noted that the Technology Readiness Level of Feed-a-Gene innovations is between 3 (Research to prove feasibility) to 7 (Demonstration and development). It is up to stakeholders to take the proposed innovations and bring them to the market. The goal of the final conference was to ensure that the realisations of the project will have impact on society in the 5, 10 or 20 years to come.

From Horizon 2020 to Horizon Europe

Jean-Charles Cavitte, Research Programme Officer at DG Agriculture and Rural Development, described the strategic approach to EU agriculture research & innovation. About 30 projects (200 M€) related to livestock production were funded under Horizon 2020. In the next programme Horizon Europe, 10 billion € are dedicated to the Cluster "Food, Bioeconomy, Natural Resources, Agriculture and Environment". Among the priorities with short and medium term impact listed by the strategic planning for agriculture, the following are relevant to livestock:

- Climate- and environmentally-friendly practices in farming
- Diversity in farming
- Better-adapted animal breeds
- Resource use efficiency in agriculture
- Implementation and upscaling of agro-ecological approaches in primary production
- Prevent, monitor and control animal pests and diseases
- Improved animal health and welfare
- Sustainability-oriented redesign of food and non-food value chains
- Data, knowledge base and impact measurements

The Horizon Europe Work Programme 2021-2022 is being drafted and the first calls for 2021 are expected by the end of 2020.

Five years of research

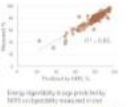
Each Work Package leader presented the objectives of their work package and the results obtained at the end of the project.

WP1: In search for European protein autonomy – more and better (Knud Erik Bach Knudsen, Aarhus University)

- European grown soybean: processes used in Feed-a-Gene involve extrusion or cooking with or without dehulling to produce expeller soybean meal with reduced content of antinutritional compounds and high protein and amino acids digestibility. These products were tested in pigs and broilers.

- Protein from green biomass: fractionation of green biomass into a protein concentrate rich in soluble protein with a higher protein and amino acids and a reduced content of antinutritional compounds. This concentrate has been tested with pigs. The fibrous pulp by-product was tested in rabbits.

- Improving the quality of rapeseed meal: tail-end separation resulted in a fine fraction with a higher protein and amino acids digestibility and less fibre and antinutritional compounds. This fraction was tested in pigs. Rapeseed meals processed with or without enzymes were tested in poultry and pigs.

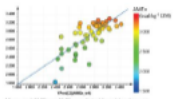


- Real-time evaluation of nutritive value: calibration equations from NIR scans based on *in vivo* data were developed, as well as equations for macronutrients, amino acids, total tract digestibility of energy and nutrients and metabolizable energy in pigs.

WP2: New animal traits for innovative livestock management strategies (Alfons Jansman, Wageningen Livestock Research)

Novel methodologies and numerous traits have been investigated:

- Measurements of individual feed intake in broilers and rabbits.
- NIRS determination in faeces for the rapid evaluation of variation in nutrient digestibility between pigs.
- Faecal microbiota composition as a trait to differentiate low and high feed efficiency pigs.
- Birth weight and breeding value for protein deposition and N-efficiency in growing pigs.



- Physical activity on heat production in sows.
- Microbiota and heat stress in pigs.
- Biomarkers in serum for AMEn in broilers.
- Predictive biomarkers in muscle tissue and blood in pigs.
- Managing variation among individuals through precision livestock feeding.

Further understanding of responses of animals to feed and nutrient intake requires simultaneous measurement of data and information on the genotype, phenotype and the environment.

New traits have been identified related to feed and nutrient efficiency in pigs, poultry and rabbits which can be used in new precision feeding concepts and future breeding programmes. However, validation of the use of the traits and biomarkers requires further attention.

WP3: FeedUtiliGene software to demonstrate modelling of biological functions (Veronika Halas, Kaposvár University)

FeedUtiliGene is a free software tool that includes 6 modules:

- The digestion module represents the transit and digestion to better understand digestive mechanisms.
- The parameter estimation module adjusts the model parameters and fits the model outputs to body weight and feed intake data.
- The nutrient partitioning module simulates growth performance, body composition, energy and amino acid partitioning and nitrogen and phosphorus excretion, and estimates digestible amino acid and P requirement.
- The fatty acid module estimates the fatty acid composition of the pig as affected by the level and source of dietary fat.
- The robustness module quantifies the robustness of the animal response in terms of resistance and resilience. It detects perturbations and characterizes the animal response.
- The stochastic module addresses variation among individuals, which may originate from differences in nutrient partitioning. The module generates a population of animals with consideration of plausible individual variance.

FeedUtiliGene can be used in education and extension services. It provides easy access to models developed in the project and published in peer-reviewed publications. The tool is useful for nutritionists and geneticists, and it provides insight on feed-use mechanisms and animal variation.

WP4: Innovative feeding technologies to improve feed efficiency and reduce the environmental impact (Jesús Pomar, Universitat de Lleida)

A common architecture has been proposed and designed to build precision feeding systems for growing pigs, sows and poultry, based in the development of 3 main components:

- Feeder devices adapted to each species or physiological state.
- Decision support system (DSS) to estimate the nutritional requirements from measured and collected data on animals. DSS have been developed for precision feeding application and adapted to pigs, sows, broilers and laying hens.
- A controlling module that integrates multiple hardware and software components.

Two pre-industrial precision feeding systems (PFS) prototypes for growing pigs have been build for demonstration and validation purposes:

- A PFS including 4 precision feeders has been installed and is operational in a commercial pig farm in the Parma region (Italy)
- A PFS including 5 precision feeders is running at the IFIP research station at Romillé (France).

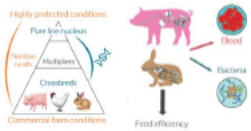
WP5: New traits and models for animal selection (Hélène Gilbert, INRAE)

The dual challenge was to increase the accuracy of breeding values via cheaper/easier measurements, and to make animals more feed-efficient when breeding conditions vary.

New traits for feed efficiency that were investigated include:

- Direct measures of feed intake in broilers and rabbits.
- Molecular indicators of feed efficiency (genomic markers of residual feed intake, selection on blood serum colour in poultry, genomic markers of growth rate in rabbits).
- Measures of components of feed efficiency that include behaviour/aggressiveness, welfare/robustness, and digestibility (in pigs).
- New traits derived from the microbiota have been studied in rabbits.

New statistical models have been developed. They include models that improve response on feed efficiency, models that account for indirect genetic effects on feed efficiency, and models that account for the individual's environmental sensitivity. Methods for using crossbred (genomic) information have been developed.



The most promising results are:

- Individual feeders in broilers and rabbits
- Group records in pigs, which may help to increase the genetic gain at a little cost
- Indicators of feed efficiency: including digestibility measurements, microbiota and biomarkers. These indicators must still be validated.
- Recommendations to use the best indicators and genomic and crossbred information.

Feed-a-Gene

WP6 - Evaluating the sustainability of new approaches to livestock feeding (Guy Garrod, Newcastle University)

Life cycle analysis was used to analyse the environmental impacts of novel European protein sources and precision feeding.

- Novel protein sources were found to have the potential to reduce climate change impact and energy consumption.
- Precision feeding can reduce nitrogen excretion in pigs, which has benefits for acidification and eutrophication. For broilers, precision feeding resulted in small improvements.

Cost-benefit analysis of the same innovations gave the following results:

- For pigs, farm net income (FNI) increased with the use of improved rapeseed meal, green protein, *ad libitum* precision feeding, or with improved traits.
- For broilers, FNI increased slightly with the use of novel soybean meals. Green protein had a negative impact.

Consumer attitudes were studied in the UK and Spain focusing on egg production:

- Consumers were willing to pay more for eggs produced with lower emissions and water use.
- Welfare and food safety were more important to consumers than prices or environmental impacts; there is a trade-off between animal welfare and environmental benefits.
- Improved feeding methods, use of animals with higher feed conversion rates, and use of novel feeds were all found to be acceptable to most consumers.

Farmers were interviewed in the UK and Spain about Feed-a-Gene innovations:

- Industry respondents were enthusiastic about precision feeding's potential to improve feed conversion efficiency and profits. There were questions about equipment reliability, costs of adoption, and savings from reduced feed use.
- Farmers were generally positive about using animal feeds incorporating green protein. They had reservations about European-grown rapeseed and soybean meal, though European soybean was seen as a GM-free alternative to imported soybean meal.

Simple composite indices have been developed to allow a comparison of the sustainability implications of different production scenarios (see the Sustainability appraisal workshop on the next page for more information on those results).

Feed-a-Gene

Discoffeery session

This session was dedicated to demonstration activities

Five demonstration areas that included booths, feeding equipment, computers, video screens and posters were set up in the lobby of the Hôtel de Rennes Métropole. A special session of 1h30 called "Discoffeery" took place on 22 January, during which Feed-a-Gene partners were present in each booth to present and discuss the results with the participants. The demonstration areas were accessible during the entire meeting.

- European protein autonomy: samples of novel feeds, 4 laptop presentations of processes and 6 posters.
- New traits and breeding schemes: rabbit cage with an individual feeder, 5 laptop presentations, 6 videos and 11 posters.
- Modelling biological functions: 5 laptop presentations about the models, 1 video and 6 posters.
- Precision feeding: precision feeding system (feeder, software and hardware), 3 videos and 5 posters.
- Sustainability assessment: 7 posters.

Sustainability appraisal workshop

This workshop consisted in a discussion on sustainability appraisal where all participants were able to share their vision of the sustainability and future of monogastric livestock production systems.

The presentation that framed the sustainability appraisal workshop was based around the proposition that the production of feed for livestock is an important contributor to the negative impacts that farming systems may have on the environment. It is then argued that changing animal feeding systems is an important approach to reducing these negative impacts. The challenge for the Feed-a-Gene project was to investigate the sustainability of the novel feeding systems proposed by the project to determine the extent to which they improve on the status quo.

The discussion took place within the context of the United Nations' Sustainable Development Goals.

- SDG2 Zero hunger: monogastric livestock production still had an important role to play where animal products were a favoured or the most accessible source of protein.
- SDG9 Industry, Innovation and Infrastructure: Feed-a-Gene developed innovations that improve the efficiency of monogastric livestock production while making it more sustainable. These technologies are meant to be turned into commercially viable products.
- SDG12 Responsible Consumption and Production: the project contributes to responsible production and promotes practices that meet the approval of consumers. As consumers seem to be more concerned by livestock welfare than by the environmental impacts of livestock production, there is a need to address possible trade-offs between livestock sustainability and animal welfare.
- SDG13 Climate Action and SDG15 Life on Land: the project's objective of reducing European reliance on Brazilian soybeans is consistent with these goals.

Participants were comfortable with the use of sustainability indicators for assessing the sustainability of feeding systems. However, some were concerned by the availability of the economic, environmental and social data that are required to implement this approach for assessing novel alternatives in the future. For that reason, the development of new technologies should be accompanied by a similar process of data collection and analysis as that implemented in the Feed-a-Gene project.

From results to innovation

Four thematic workshops were dedicated to the applicability and exploitation of Feed-a-Gene results

The objective of the workshops was to produce SWOT analyses. – Strengths, Weaknesses, Opportunities, Threats – to help stakeholders to transform the outputs of Feed-a-Gene into products that are economically and environmentally sustainable, and socially acceptable.

New feeds and processes and nutrition: protein supply, nutritive value assessment

Soybean is a very good ingredient that is hard to beat: novel feeds should be complementary rather than whole substitutes. For novel feeds, the questions of nutritional quality, variability, availability, costs, and consumer acceptance should be considered.

Big Data and modelling

The models and tools developed in Feed-a-Gene provide opportunities for characterisation and prediction, and take advantage of "big data" availability. While they are useful for academic purposes (research and higher education), their value for farmers and industrial stakeholders needs to be validated.

Genetics and breeding: new traits/bioindicators and breeding schemes

The Feed-a-Gene geneticists have provided results on how to improve feed efficiency. Still, there is a need to broaden the focus, by including other aspects of livestock production such as alternate feeds, or even by looking at other directions, including sustainability and social demands.

Novel feeding technologies: precision feeding

Livestock precision farming has a lot to offer in terms of improved efficiency - technical, economic and environmental -, with a potentially positive effect on social acceptance. It still need to be validated in terms of ROI, complexity, and image if communication about it too technology-centred.

Roxil Lizardo (IRTA) moderating the "new feeds" workshop

Final discussion: Which future for livestock production?

The final session was a round table where the speakers of the past two days exchanged ideas with stakeholders in the audience.

The main issue discussed in the round table was communication. Stakeholders are concerned that the future of livestock production is being threatened by a growing disconnect between the general public and livestock farming, fuelled by a lack of knowledge about agriculture and by the dissemination of misleading information. They agree that communication towards the general public is key to fight this trend. This communication should be structured and involve the industry, scientists and policy makers. It should be handled by communication specialists and organizations such as NGOs that have their own channels, though everyone in the sector should play their part. Communication should target the general public, starting in primary schools, and it should use the same tools as those used by critics of livestock farming, particularly social media. The message should use accessible language, as well as facts and figures to emphasize the values and positive impacts brought by livestock farming, making it part of the solution rather than a problem. It should be very open, highlighting the changes without ignoring the past. Finally, it was recommended that future projects involve members of the civil society, such as NGOs, and include in the project, from the very start, the questions raised by these stakeholders.

Another issue discussed in the final session was the tension between global and local sustainability: are solutions that are sustainable at local level still sustainable at global level? There is also a tension between animal welfare goals (much favoured by the general public) and environmental goals. Other issues discussed were the decreasing European leadership and the lack of level playing field in a world dominated by Asia and the Americas.

Leo den Hartog (Stakeholder advisory board)

Other events

Feed-a-Gene partners organized or participated in numerous events in 2019-2020

Precision feeding demonstrations

10 April 2019, 7 June 2019 and 3 February 2020, Parma, Italy

A precision feeding system for growing pigs was installed early 2019 at Campo Bo, a commercial pig farm in Montechiarugolo, province of Parma, Italy. Three events were organized by Gran Suino Italiano, assisted by Exafan, University of Lleida, INRAE, and IFIP to present this innovation and to promote its adoption by farmers.

A visit was organized on 10 April 2019 at Campo Bo for representatives of the Confagricoltura Emilia Romagna farmer union. After a presentation of precision feeding technology, the visitors were given a tour of the facilities, where they could watch the operation of the precision feeding system. Two "virtual tours" were held for pig farmers at the Chamber of Commerce in Modena on 7 June 2019 and 3 February 2020. Participants were shown a presentation and a video of the Campo Bo precision feeding system.

ASESCU

5-6 June 2019, Burgos, Spain

Feed-a-Gene was present in the IRTA booth at the 44th Symposium on Cuniculture in Spain. There was a roll-up poster in Spanish showing the main results of the project, and a rabbit cage equipped with a recording system for individual feed intake. The meeting was attended by 170 participants.

J.P. Sanchez (INRA) shows the prototype rabbit cage at ASESCU.

Agri Innovation Summit

25-26 June 2019, Lisieux, France

Jaap van Milgen presented the Feed-a-Gene at the Agri Innovation Summit, a conference highlighting the potential of interactive innovation to address the challenges faced by European agriculture. The event brought together over 400 participants.

The poster session at the Agri Innovation Summit

FEFAC seminar: European protein autonomy - more and better

8 October 2019, Copenhagen, Denmark

This Feed-a-Gene seminar associated to the Annual meeting of FEFAC presented the novel feeds and the NIRS prediction method developed in WP1 to an audience of representatives of the European feed industry.

WP1 researchers at the FEFAC seminar: P. Bikker (WUR), S. J. Noel (AU), E. Royer (IFIP), K.E. Bach Knudsen (AU) and S.K. Jensen (AU)

Animal Taskforce workshop

6 November 2019, Brussels, Belgium

Feed-a-Gene, as a member of the Fitter Livestock Farming Common Dissemination Booster Cluster (which also includes the projects SmartCow, GenTORE, IMAGE, SAPHIR and GplusE), participated in the session "What

Nicolas Friggens (GenTORE) and Jaap van Milgen (Feed-a-Gene) at the ATF workshop

research and innovation can deliver to support climate mitigation and adaptation in livestock farming?" organized during the 9th Animal Task Force seminar for an audience of policy makers.

Feed-a-Gene: 5 year advances for breeding towards improved feed efficiency

12 December 2019, Wageningen, Netherlands

This seminar organized by Wageningen University & Research was dedicated to the presentation of results obtained in the Work packages 2 (novel traits) and 5 (traits for animal selections). It included 5 presentations by researchers from WUR and Topigs. The seminar was streamed live on the WUR video channel.

52èmes Journées de la recherche porcine

4-5 January 2020, Paris, France

The Journées de la Recherche Porcine had a focus on Feed-a-Gene. This conference targeted at pig production specialists featured 7 presentations and 3 posters by Feed-a-Gene researchers. It was attended by about 400 people.

Other conferences

Feed-a-Gene researchers also participated in the following events:

- Evonik Takarmányozási konferencia és partnertalálkozó, 4 June 2019, Egerszalók, Hungary
- 26th International Conference KRMIVA, 5-7 June 2019, Opatija, Croatia
- 37th International Society for Animal Genetics Conference, 7-12 July 2019, Lleida, Spain
- ASAS-CSAS 2019,8-11 July 2019, Austin, Texas, United States
- 70th EAAP meeting, 26-30 August 2019, Ghent, Belgium
- 6th International Symposium on Energy and Protein Metabolism and Nutrition, 9-12 September 2019, Belo Horizonte, Minas Gerais, Brazil
- MODNUT 2019, 14-16 September 2019, Ubatuba, Brazil
- 27th Animal Science Days, 19-20 September 2019, Prague, Czech Republic
- 3rd China Pig Industry Science and Technology Conference, 19-21 September, Qingdao, China
- LXI. Georgikon, 3-4 October 2019, Keszthely, Hungary
- 3rd World Conference on Innovative Animal Nutrition and Feeding (WIANF), 9-11October 2019, Budapest, Hungary
- 11th European symposium of Poultry Genetics, 23–25 October 2019, Prague, Czech Republic
- Association for the Advancement of Animal Breeding and Genetics, 27 October - 1 November 2019, Armidale, Australia
- 85th Anniversary of Scholthorst Feed Research, 26-27 November 2019, Nijkerk, Netherlands

Publications

Feed-a-Gene researchers have made more than 250 publications, including 33 peer-reviewed papers. Here are the 12 papers published since June 2019.

- Cowton J., Kyriazakis I., Bacardit J., 2019. Automated individual pig localisation, tracking and behaviour metric extraction using deep learning. IEEE Access, 5 August 2019. DOI: 10.1109/ACCESS.2019.2933060
- de la Fuente G., Yañez-Ruiz D.R., Saro J. A.R., Balcells J., Belanche A., 2019. Methanogenesis in animals with foregut and hindgut fermentation: a review, Animal Production Science, Published online 13 September 2019. DOI: 10.1071/AN17701
- Faverdin P., van Milgen J., 2019. Intégrer les changements d'échelle pour améliorer l'efficience des animaux et réduire les rejets, INRA Productions animales, 305-322. DOI: 10.1186/s12711-019-0471-9
- Filipe J.A.N., Kyriazakis I., 2019. Bayesian, likelihood-free modelling of phenotypic plasticity and variability in individuals and populations, Frontiers in Genetics, 20 September 2019. DOI: 10.3389/fgene.2019.00727
- Fonseca-Rafarty N., Cervantes I., Sánchez J.P., Gutiérrez J.P., Bodin L., 2019. Effect of feed restriction on the environmental variability of birth weight in divergently selected lines of mice, Genetics Selection Evolution, 51: 27. DOI: 10.1186/s12711-019-0471-9
- Herrera-Cáceres W., Ragab M., Sánchez J. P., 2019. Indirect genetic effects on the relationships between production and feeding behaviour traits in growing Duroc pigs. Animal, published online 1 October 2019, 10 p.. DOI: 10.1017/S1751731119002179
- Le Sciellour M., Zemb O., Hochu I., Riquet J., Gilbert H., Giorgi M., Billon Y., Gourdine J.-L., Renaudeau D., 2019. Effect of chronic and acute heat challenges on fecal microbiota composition, production, and thermoregulation traits in growing pigs, Journal of Animal Science, 97 (9): 3645-3656. DOI: 10.1093/jas/skz222
- Messad F., Louveau I., Koffi B., Gilbert H., Gondret F., 2019. Investigation of muscle transcriptomes using gradient boosting learning machine identifies molecular predictors of feed efficiency in growing pigs, BMC Genomics, 20: 659. DOI: 10.1186/s12864-019-6030-9
- Mignon-Grasteau S., Beaucleroz S., Urvois S., Le Bihan-Duval E., 2020. Interet in the serum color as an indirect criterion of selection of digestive efficiency in chickens, Poultry Science, 99 (2): 702-707. DOI: 10.3016/j.psj.2019.10.005
- Nguyen-Ba H., Van Milgen J., Taghipoor M., 2019. A procedure to quantify the feed intake response of growing pigs to perturbations, Animal, published on 23 August 2019, 8 p.. DOI: 10.1017/S1751731119001976
- Ollivon M., Mackenzie S., Wallace M., Kyriazakis I., 2019. A method to estimate the environmental impacts from genetic change in pig production systems, Int. J. Life Cycle Assess., 14 November 2019. DOI: 10.1007/s11367-019-01686-8
- Pilas M., Marti J., Relasch J., Sánchez J.P., 2019. Genetic parameters of sow feed efficiency during lactation and its underlying traits in a Duroc population, Animal, 25 November 2019. DOI: 10.1017/s1751731119002842

The 6 Feed-a-Gene factsheets are available!

www.feed-a-gene.eu/media/factsheets

2.3.2 Contents

The 5th Feed-a-Gene newsletter contains the following:

- Editorial by the Project coordinator Jaap van Milgen (INRA)
- A report about the Final meeting of the Feed-a-Gene project that took place in January 2020 in Rennes, France
- Short reports about other Feed-a-Gene events that took place since May 2019.
- A list of 12 peer-reviewed papers published since the 4th newsletter
- Upcoming conferences

2.3.3 Dissemination

An email informing of the publication of the 5th annual newsletter was sent to 462 registered stakeholders at the end of February 2019.

The newsletters are available to all visitors on the website (https://www.feed-a-gene.eu/media/newsletter). Information about the newsletters was disseminated on social media (i.e., Facebook, Twitter, and LinkedIn).

3 Demonstrations events

3.1 Discoffeery session held during the Final meeting

The Discoffeery™ session was an 1h30 session that took place during the final meeting of Feed-a-Gene. It was organized around five demonstration areas where conference participants were able to discover the results obtained by the project through interactions with Feed-a-Gene partners. The demonstration areas included booths, laptop presentations, software, videos, posters, and equipment prototypes. There were 146 participants.

3.2 Demonstration the precision feeding system in Italy

A precision feeding system for growing pigs was installed early 2019 at the Campo Bo farm, a commercial pig farm in Montechiarugolo, province of Parma, Italy. Three events were organized by Gran Suino Italiano. One visit was organized at the Campo Bo farm on 10 April 2019 for 7 representatives of the regional farmer's union, and 2 other events consisted in presentations held at the Chamber of Commerce in Modena to audiences of about pig farmers on 7 June 2019 and 3 February 2020 (30 and 38 people attending respectively).

Note: other demonstrations of precision feeding that should have taken place in Italy and France were cancelled to the African Swine fever outbreak.

4 Stakeholder meetings

4.1 Final meeting of the Feed-a-Gene project, 22-23 January 2020, Rennes, France

The Feed-a-Gene project held its final meeting at Hôtel de Rennes Métropole in Rennes, France. The aim of the meeting was to present the results of five years of research and innovation addressing key issues for the future of monogastric animal production. The meeting lasted 1.5 days. The plenary sessions were filmed and can be watched here: https://www.youtube.com/channel/UCfjCBWHDOYLo1N_V60aWNPA/. The presentations and posters shown during the conference can be downloaded from here: https://www.feed-a-gene.eu/news/feed-a-gene-final-meeting-factsheets-presentations-posters-and-videos

The audience consisted in 146 participants from 11 countries. 68% of the participants were from French organizations. Half of the participants belonged to R&D organisations or academic institutions that were, for most of them, partners of the Feed-a-Gene consortium. More than 60% of the stakeholders from organizations outside the Feed-a-Gene consortium came from the industry (e.g., feed industry, genetics, equipment).

The meeting programme consisted in the following:

- A plenary session with two keynote addresses and short presentations of the results obtained after five years.
- A demonstration session (Discoffeery™) with booths showing prototypes, presentations, and videos.
- A thematic workshop session where participants could brainstorm about the opportunities and threats to turn Feed-a-Gene results into actual products.
- A final plenary session that included a sustainability appraisal workshop (see Deliverable D6.6), a wrap-up discussion of the thematic workshops, and discussion about the future of livestock production.

4.2 FEFAC seminar: European protein autonomy - more and better (WP1), 8 October 2019, Copenhagen, Denmark

This meeting was organized by WP1 researchers to present the results of this work package (Alternative feed ingredients and real-time characterisation) to the members of European Feed Manufacturers' Federation (FEFAC).

4.3 Animal Task Force seminar: “What research and innovation can deliver to support climate mitigation and adaptation in livestock farming?”, 6 November 2019, Brussels, Belgium

This seminar was organized by the projects that are part of the “Fitter Livestock Farming” Common Dissemination Booster Cluster (which includes Feed-a-Gene, SmartCow, GenTORE, IMAGE, SAPHIR and GplusE). It presented the different projects to an audience of policy makers.

4.4 Feed-a-Gene: 5 year advances for breeding towards improved feed efficiency (WP2-WP5), 12 December 2019, Wageningen, Netherlands

This meeting was organized by researchers in the WP2 and WP5 (novel traits and use of traits in animal selection) and presented the results of these work packages to an audience of researchers.

4.5 52ème Journées de la Recherche Porcine (4-5 February, Paris, France)

This annual meeting dedicated to pig production research in France was in part dedicated to Feed-a-Gene, and all WP were represented by oral communications (7) and posters (3), with an audience of about 400 people.

5 Conclusions

The fifth newsletter is a dissemination tool meant to inform stakeholders and consortium partners of the final state of the project.

The demonstrations and stakeholder meetings showed practical results of the work done in all work packages and were the occasion for Feed-a-Gene partners to interact with potential users, both at national and international level.

6 Partners involved in the work

All partners contributed this deliverable.

7 Annexes

- Fifth Feed-a-Gene newsletter in PDF format.
- Minutes of the two demonstrations of the final meeting.
- Flyers of various Feed-a-Gene meetings and demonstrations.

Feed-a-Gene

Newsletter #5

March 2020

Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems

Editorial

Dear readers,

We are honoured to present the fifth newsletter of the Feed-a-Gene project funded through the Horizon 2020 programme of the European Union. As our project is now completed, this newsletter is dedicated to the final meeting held on 22-23 January in France. It presents the results shown during that conference and the discussions that took place between the partners and the stakeholders.

Feed-a-Gene has been a huge endeavour for all of those involved. More than 100 people from 23 organizations have been working together for 5 years, and we can all be proud of the work that has been accomplished. Feed-a-Gene results have been disseminated in 240 publications, including more than 30 peer-reviewed papers. They cover a wide range of technology readiness: some are opening new doors and their promises are exciting; others are at the prototype stage and are already implemented in the field.

Feed-a-Gene is now finished, but the research goes on, and it is up to the stakeholders to pick up these results and turn them into practical innovations that are profitable for the society and for the environment.

Jaap van Milgen (INRAE)
Feed-a-Gene project coordinator

The Feed-a-Gene Project has received funding from the European Union's H2020 Programme under grant agreement no 633531

Final Feed-a-Gene meeting

22-23 January, Rennes, France

The final meeting of the Feed-a-Gene project took place on 22-23 January at the Hotel de Rennes Métropole in Rennes, France.

It was organized by AFZ, the partner in charge of communication and dissemination.

Rennes Métropole is an intercommunal structure centred on the city of Rennes, in the Brittany region.

The final meeting of the Feed-a-Gene project took place in Rennes, France. This 2-day conference was open to all Feed-a-Gene stakeholders: it was attended by 146 people, half of them from organizations not in the original consortium. During the conference, Feed-a-Gene partners presented the results of the project, and stakeholders were able to provide feedbacks and ideas during the plenary sessions, demonstrations, poster presentations and workshops.

Project coordinator Jaap van Milgen and meeting organizers Valérie Heuzé and Gilles Tran would like to thank the staff of the Hôtel de Rennes Métropole who made this meeting possible and enjoyable.

The presentations, posters and videos are available on the Feed-a-Gene website. CLICK HERE

Keynote speakers

Introduction

Isabelle Pellerin, vice-president of Rennes Métropole, introduced the conference by thanking the organizers for setting it up in Brittany, which is the first agricultural region of France.

"We need you"

In the first presentation of the plenary session, Jaap van Milgen gave the audience a brief overview of what the project did in the past five years: novel feeds for increasing protein autonomy in Europe; novel traits to observe variation; new traits and models for the genetic improvement of feed efficiency; new models of biological function for understanding and predicting animal response; precision feeding systems; a sustainability assessment of the solutions proposed by the project.

Jaap van Milgen noted that the Technology Readiness Level of Feed-a-Gene innovations is between 3 (Research to prove feasibility) to 7 (Demonstration and development). It is up to stakeholders to take the proposed innovations and bring them to the market. The goal of the final conference was to ensure that the realisations of the project will have impact on society in the 5, 10 or 20 years to come.

From Horizon 2020 to Horizon Europe

Jean-Charles Cavitte, Research Programme Officer at DG Agriculture and Rural Development, described the strategic approach to EU agriculture research & innovation. About 30 projects (200 M€) related to livestock production were funded under Horizon 2020. In the next programme Horizon Europe, 10 billion € are dedicated to the Cluster "Food, Bioeconomy, Natural Resources, Agriculture and Environment". Among the priorities with short and medium term impact listed by the strategic planning for agriculture, the following are relevant to livestock:

- Climate- and environmentally-friendly practices in farming
- Diversity in farming
- Better-adapted animal breeds
- Resource use efficiency in agriculture
- Implementation and upscaling of agro-ecological approaches in primary production
- Prevent, monitor and control animal pests and diseases
- Improved animal health and welfare
- Sustainability-oriented redesign of food and non-food value chains
- Data, knowledge base and impact measurements

The Horizon Europe Work Programme 2021-2022 is being drafted and the first calls for 2021 are expected by the end of 2020.

Five years of research

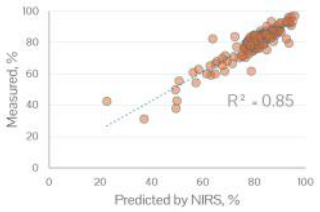
Each Work Package leader presented the objectives of their work package and the results obtained at the end of the project.

WP1: In search for European protein autonomy – more and better (Knud Erik Bach Knudsen, Aarhus University)

- European grown soybean: processes used in Feed-a-Gene involve extrusion or cooking with or without dehulling to produce expeller soybean meal with reduced content of antinutritional compounds and high protein and amino acids digestibility. These products were tested in pigs and broilers.

- Protein from green biomass: fractionation of green biomass into a protein concentrate rich in soluble protein with a higher protein and amino acids and a reduced content of antinutritional compounds. This concentrate has been tested with pigs. The fibrous pulp by-product was tested in rabbits.

- Improving the quality of rapeseed meal: tail-end separation resulted in a fine fraction with a higher protein and amino acids digestibility and less fibre and antinutritional compounds. This fraction was tested in pigs. Rapeseed meals processed with or without enzymes were tested in poultry and pigs.



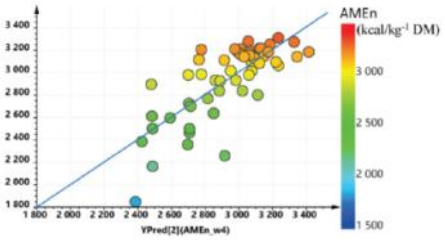
Energy digestibility in pigs predicted by NIRS *vs* digestibility measured *in vivo*

- Real-time evaluation of nutritive value: calibration equations from NIR scans based on *in vivo* data were developed, as well as equations for macronutrients, amino acids, total tract digestibility of energy and nutrients and metabolizable energy in pigs.

WP2: New animal traits for innovative livestock management strategies (Alfons Jansman, Wageningen Livestock Research)

Novel methodologies and numerous traits have been investigated:

- Measurements of individual feed intake in broilers and rabbits.
- NIRS determination in faeces for the rapid evaluation of variation in nutrient digestibility between pigs.
- Faecal microbiota composition as a trait to differentiate low and high feed efficiency pigs.
- Birth weight and breeding value for protein deposition and N-efficiency in growing pigs.
- Physical activity on heat production in sows.



Measured AMEn *vs* AMEn predicted from blood serum in chickens (Beauclercq et al., 2018).

- Microbiota and heat stress in pigs.
- Biomarkers in serum for AMEn in broilers.
- Predictive biomarkers in muscle tissue and blood in pigs.
- Managing variation among individuals through precision livestock feeding.

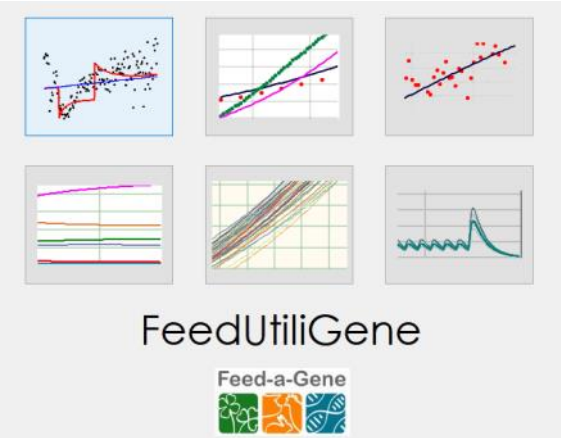
Further understanding of responses of animals to feed and nutrient intake requires simultaneous measurement of data and information on the genotype, phenotype and the environment.

New traits have been identified related to feed and nutrient efficiency in pigs, poultry and rabbits which can be used in new precision feeding concepts and future breeding programmes. However, validation of the use of the traits and biomarkers requires further attention.

WP3: FeedUtiliGene software to demonstrate modelling of biological functions (Veronika Halas, Kaposvár University)

FeedUtiliGene is a free software tool that includes 6 modules:

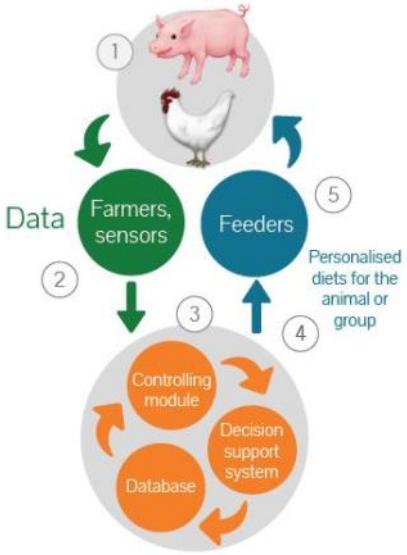
- The digestion module represents the transit and digestion to better understand digestive mechanisms.
- The parameter estimation module adjusts the model parameters and fits the model outputs to body weight and feed intake data.
- The nutrient partitioning module simulates growth performance, body composition, energy and amino acid partitioning and nitrogen and phosphorus excretion, and estimates digestible amino acid and P requirement.
- The fatty acid module estimates the fatty acid composition of the pig as affected by the level and source of dietary fat.
- The robustness module quantifies the robustness of the animal response in terms of resistance and resilience. It detects perturbations and characterizes the animal response.
- The stochastic module addresses variation among individuals, which may originate from differences in nutrient partitioning. The module generates a population of animals with consideration of plausible individual variance.



FeedUtiliGene can be used in education and extension services. It provides easy access to models developed in the project and published in peer-reviewed publications. The tool is useful for nutritionists and geneticists, and it provides insight on feed-use mechanisms and animal variation.

WP4: Innovative feeding technologies to improve feed efficiency and reduce the environmental impact (Jesús Pomar, Universitat de Lleida)

A common architecture has been proposed and designed to build precision feeding systems for growing pigs, sows and poultry, based in the development of 3 main components:



- Feeder devices adapted to each species or physiological state.
- Decision support system (DSS) to estimate the nutritional requirements from measured and collected data on animals. DSS have been developed for precision feeding application and adapted to pigs, sows, broilers and laying hens.
- A controlling module that integrates multiple hardware and software components.

Two pre-industrial precision feeding systems (PFS) prototypes for growing pigs have been build for demonstration and validation purposes:

- A PFS including 4 precision feeders has been installed and is operational in a commercial pig farm in the Parma region (Italy)
- A PFS including 5 precision feeders is running at the IFIP research station at Romillé (France).

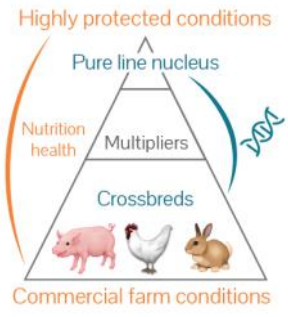
WP5: New traits and models for animal selection (Hélène Gilbert, INRAE)

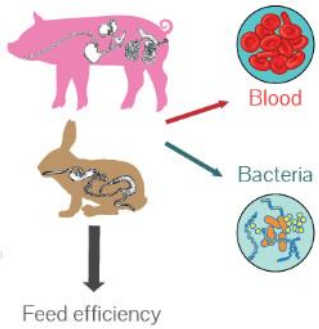
The dual challenge was to increase the accuracy of breeding values via cheaper/easier measurements, and to make animals more feed-efficient when breeding conditions vary.

New traits for feed efficiency that were investigated include:

- Direct measures of feed intake in broilers and rabbits.
- Molecular indicators of feed efficiency (genomic markers of residual feed intake, selection on blood serum colour in poultry, genomic markers of growth rate in rabbits).
- Measures of components of feed efficiency that include behaviour/aggressiveness, welfare/robustness, and digestibility (in pigs).
- New traits derived from the microbiota have been studied in rabbits.

New statistical models have been developed. They include models that improve response on feed efficiency, models that account for indirect genetic effects on feed efficiency, and models that account for the individual's environmental sensitivity. Methods for using crossbred (genomic) information have been developed.





The most promising results are:

- Individual feeders in broilers and rabbits
- Group records in pigs, which may help to increase the genetic gain at a little cost
- Indicators of feed efficiency: including digestibility measurements, microbiota and biomarkers. These indicators must still be validated.
- Recommendations to use the best indicators and genomic and crossbred information.

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WP6 - Evaluating the sustainability of new approaches to livestock feeding (Guy Garrod, Newcastle University)

Life cycle analysis was used to analyse the environmental impacts of novel European protein sources and precision feeding.

- Novel protein sources were found to have the potential to reduce climate change impact and energy consumption.
- Precision feeding can reduce nitrogen excretion in pigs, which has benefits for acidification and eutrophication. For broilers, precision feeding resulted in small improvements.

Cost-benefit analysis of the same innovations gave the following results:

- For pigs, farm net income (FNI) increased with the use of improved rapeseed meal, green protein, *ad libitum* precision feeding, or with improved traits.
- For broilers, FNI increased slightly with the use of novel soybean meals. Green protein had a negative impact.

Consumer attitudes were studied in the UK and Spain focusing on egg production:

- Consumers were willing to pay more for eggs produced with lower emissions and water use.
- Welfare and food safety were more important to consumers than prices or environmental impacts; there is a trade-off between animal welfare and environmental benefits.
- Improved feeding methods, use of animals with higher feed conversion rates, and use of novel feeds were all found to be acceptable to most consumers.

Farmers were interviewed in the UK and Spain about Feed-a-Gene innovations:

- Industry respondents were enthusiastic about precision feeding's potential to improve feed conversion efficiency and profits. There were questions about equipment reliability, costs of adoption, and savings from reduced feed use.
- Farmers were generally positive about using animal feeds incorporating green protein. They had reservations about European-grown rapeseed and soybean meal, though European soybean was seen as a GM-free alternative to imported soybean meal.

Simple composite indices have been developed to allow a comparison of the sustainability implications of different production scenarios (see the Sustainability appraisal workshop on the next page for more information on these results).

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Precision feeder prototype (Exafan, INRAE, IFIP)

Rabbit cage equipped with individual recording device (IRTA)

Discoffeery session

This session was dedicated to demonstration activities

Five demonstration areas that included booths, feeding equipment, computers, video screens and posters were set up in the lobby of the Hôtel de Rennes Métropole. A special session of 1h30 called "Discoffeery" took place on 22 January, during which Feed-a-Gene partners were present in each booth to present and discuss the results with the participants. The demonstration areas were accessible during the entire meeting.

- European protein autonomy: samples of novel feeds, 4 laptop presentations of processes and 6 posters.
- New traits and breeding schemes: rabbit cage with an individual feeder, 5 laptop presentations, 6 videos and 11 posters.
- Modelling biological functions: 5 laptop presentations about the models, 1 video and 6 posters.
- Precision feeding: precision feeding system (feeder, software and hardware), 3 videos and 5 posters.
- Sustainability assessment: 7 posters .

Sustainability appraisal workshop

This workshop consisted in a discussion on sustainability appraisal where all participants were able to share their vision of the sustainability and future of monogastric livestock production systems.

The presentation that framed the sustainability appraisal workshop was based around the proposition that the production of feed for livestock is an important contributor to the negative impacts that farming systems may have on the environment. It is then argued that changing animal feeding systems is an important approach to reducing these negative impacts. The challenge for the Feed-a-Gene project was to investigate the sustainability of the novel feeding systems proposed by the project to determine the extent to which they improve on the status quo.

The discussion took place within the context of the United Nations' Sustainable Development Goals.

- SDG2 Zero hunger: monogastric livestock production still had an important role to play where animal products were a favoured or the most accessible source of protein.
- SDG9 Industry, Innovation and Infrastructure: Feed-a-Gene developed innovations that improve the efficiency of monogastric livestock production while making it more sustainable. These technologies are meant to be turned into commercially-viable products.
- SDG12 Responsible Consumption and Production: the project contributes to responsible production and promotes practices that meet the approval of consumers. As consumers seem to be more concerned by livestock welfare than by the environmental impacts of livestock production, there is a need to address possible trade-offs between livestock sustainability and animal welfare.
- SDG13 Climate Action and SDG15 Life on Land: the project's objective of reducing European reliance on Brazilian soybeans is consistent with these goals.

Participants were comfortable with the use of sustainability indicators for assessing the sustainability of feeding systems. However, some were concerned by the availability of the economic, environmental and social data that are required to implement this approach for assessing novel alternatives in the future. For that reason, the development of new technologies should be accompanied by a similar process of data collection and analysis as that implemented in the Feed-a-Gene project.

From results to innovation

Four thematic workshops were dedicated to the applicability and exploitation of Feed-a-Gene results

The objective of the workshops was to produce SWOT analyses,– Strengths, Weaknesses, Opportunities, Threats – to help stakeholders to transform the outputs of Feed-a-Gene into products that are economically and environmentally sustainable, and socially acceptable.

New feeds and processes and nutrition: protein supply, nutritive value assessment

Soybean is a very good ingredient that is hard to beat: novel feeds should be complementary rather than whole substitutes. For novel feeds, the questions of nutritional quality, variability, availability, costs, and consumer acceptance should be considered.

Big Data and modelling

The models and tools developed in Feed-a-Gene provide opportunities for characterisation and prediction, and take advantage of "big data" availability. While they are useful for academic purposes (research and higher education), their value for farmers and industrial stakeholders needs to be validated.

Genetics and breeding: new traits/bioindicators and breeding schemes

The Feed-a-Gene geneticists have provided results on how to improve feed efficiency. Still, there is a need to broaden the focus, by including other aspects of livestock production such as alternate feeds, or even by looking at other directions, including sustainability and social demands.

Novel feeding technologies: precision feeding

Livestock precision farming has a lot to offer in terms of improved efficiency - technical, economic and environmental -, with a potentially positive effect on social acceptance. It still need to be validated in terms of ROI, complexity, and image if communication about it too technology-centred.

Rosil Lizardo (IRTA) moderating the “new feeds” workshop

Final discussion: Which future for livestock production?

The final session was a round table where the speakers of the past two days exchanged ideas with stakeholders in the audience.

The main issue discussed in the round table was communication. Stakeholders are concerned that the future of livestock production is being threatened by a growing disconnect between the general public and livestock farming, fuelled by a lack of knowledge about agriculture and by the dissemination of misleading information. They agree that communication towards the general public is key to fight this trend. This communication should be structured and involve the industry, scientists and policy makers. It should be handled by communication specialists and organizations such as NGOs that have their own channels, though everyone in the sector should play their part. Communication should target the general public, starting in primary schools, and it should use the same tools as those used by critics of livestock farming, particularly social media. The message should use accessible language, as well as facts and figures to emphasize the values and positive impacts brought by livestock farming, making it part of the solution rather than a problem. It should be very open, highlighting the changes without ignoring the past. Finally, it was recommended that future projects involve members of the civil society, such as NGOs, and include in the project, from the very start, the questions raised by these stakeholders.

Leo den Hartog (Stakeholder advisory board)

Another issue discussed in the final session was the tension between global and local sustainability: are solutions that are sustainable at local level still sustainable at global level? There is also a tension between animal welfare goals (much favoured by the general public) and environmental goals. Other issues discussed were the decreasing European leadership and the lack of level playing field in a world dominated by Asia and the Americas.

Other events

Feed-a-Gene partners organized or participated in numerous events in 2019-2020

Precision feeding demonstrations

10 April 2019, 7 June 2019 and 3 February 2020, Parma, Italy

A precision feeding system for growing pigs was installed early 2019 at Campo Bo, a commercial pig farm in Montechiarugolo, province of Parma, Italy. Three events were organized by Gran Suino Italiano, assisted by Exafan, University of Lleida, INRAE, and IFIP to present this innovation and to promote its adoption by farmers.

A visit was organized on 10 April 2019 at Campo Bo for representatives of the Confagricoltura Emilia Romagna farmer union. After a presentation of precision feeding technology, the visitors were given a tour of the facilities, where they could watch the operation of the precision feeding system. Two "virtual tours" were held for pig farmers at the Chamber of Commerce in Modena on 7 June 2019 and 3 February 2020. Participants were shown a presentation and a video of the Campo Bo precision feeding system.

ASESCU

5-6 June 2019, Burgos, Spain

J.P. Sanchez (INRA) shows the prototype rabbit cage at ASESCU.

Feed-a-Gene was present in the IRTA booth at the 44th Symposium on Cuniculture in Spain. There was a roll-up poster in Spanish showing the main results of the project, and a rabbit cage equipped with a recording system for individual feed intake. The meeting was attended by 170 participants.

Agri Innovation Summit

25-26 June 2019, Lisieux, France

The poster session at the Agri Innovation Summit

Jaap van Milgen presented the Feed-a-Gene at the Agri Innovation Summit, a conference highlighting the potential of interactive innovation to address the challenges faced by European agriculture. The event brought together over 400 participants.

FEFAC seminar: European protein autonomy - more and better

8 October 2019, Copenhagen, Denmark

WP1 researchers at the FEFAC seminar: P. Bikker (WUR); S. J. Noel (AU), E. Royer (IFIP), K.E. Bach Knudsen (AU) and S.K. Jensen (AU)

This Feed-a-Gene seminar associated to the Annual meeting of FEFAC presented the novel feeds and the NIRS prediction method developed in WP1 to an audience of representatives of the European feed industry.

Animal Taskforce workshop

6 November 2019, Brussels, Belgium

Feed-a-Gene, as a member of the Fitter Livestock Farming Common Dissemination Booster Cluster (which also includes the projects SmartCow, GenTORE, IMAGE, SAPHIR and GplusE), participated in the session "What

Nicolas Friggens (GenTORE) and Jaap van Milgen (Feed-a-Gene) at the ATF workshop

research and innovation can deliver to support climate mitigation and adaptation in livestock farming?" organized during the 9th Animal Task Force seminar for an audience of policy makers.

Feed-a-Gene: 5 year advances for breeding towards improved feed efficiency

12 December 2019, Wageningen, Netherlands

This seminar organized by Wageningen University & Research was dedicated to the presentation of results obtained in the Work packages 2 (novel traits) and 5 (traits for animal selections). It included 5 presentations by researchers from WUR and Topigs. The seminar was streamed live on the WUR video channel.

52èmes Journées de la recherche porcine

4-5 January 2020, Paris, France

The Journées de la Recherche Porcine had a focus on Feed-a-Gene. This conference targeted at pig production specialists featured 7 presentations and 3 posters by Feed-a-Gene researchers. It was attended by about 400 people.

Other conferences

Feed-a-Gene researchers also participated in the following events:

- Evonik Takarmányozási konferencia és partnertalálkozó, 4 June 2019, Egerszalók, Hungary
- 26th International Conference KRMIVA, 5-7 June 2019, Opatija, Croatia
- 37th International Society for Animal Genetics Conference, 7-12 July 2019, Lleida, Spain
- ASAS-CSAS 2019,8-11 July 2019, Austin, Texas, United States
- 70th EAAP meeting, 26-30 August 2019, Ghent, Belgium
- 6th International Symposium on Energy and Protein Metabolism and Nutrition, 9-12 September 2019, Belo Horizonte, Minas Gerais, Brazil
- MODNUT 2019, 14-16 September 2019, Ubatuba, Brazil
- 27th Animal Science Days, 19-20 September 2019, Prague, Czech Republic
- 3rd China Pig Industry Science and Technology Conference, 19-21 September, Qingdao, China
- LXI. Georgikon, 3-4 October 2019, Keszthely, Hungary
- 3rd World Conference on Innovative Animal Nutrition and Feeding (WIANF), 9-11October 2019, Budapest, Hungary
- 11th European symposium on Poultry Genetics, 23–25 October 2019, Prague, Czech Republic
- Association for the Advancement of Animal Breeding and Genetics, 27 October - 1 November 2019, Armidale, Australia
- 85th Anniversary of Schothorst Feed Research, 26-27 November 2019, Nijkerk, Netherlands


Hélène Gilbert, INRAE


Florence Gondret, INRAE


Mathilde Le Sciellour, INRAE

Publications

Feed-a-Gene researchers have made more than 250 publications, including 33 peer-reviewed papers. Here are the 12 papers published since June 2019.

- Cowton J., Kyriazakis I., Bacardit J., 2019. Automated individual pig localisation, tracking and behaviour metric extraction using deep learning, IEEE Access, 5 August 2019. DOI: 10.1109/ACCESS.2019.2933060
- de la Fuente G., Yañez-Ruiz D.R., Seradj A.R., Balcells J., Belanche A., 2019. Methanogenesis in animals with foregut and hindgut fermentation: a review, Animal Production Science, Published online 13 September 2019. DOI: 10.1071/AN17701
- Faverdin P., van Milgen J., 2019. Intégrer les changements d'échelle pour améliorer l'efficience des animaux et réduire les rejets, INRA Productions animales, 305-322. DOI: 10.1186/s12711-019-0471-9
- Filipe J.A.N., Kyriazakis I., 2019. Bayesian, likelihood-free modelling of phenotypic plasticity and variability in individuals and populations, Frontiers in Genetics, 20 September 2019. DOI: 10.3389/fgene.2019.00727
- Formoso-Raferty N., Cervantes I., Sánchez J.P., Gutiérrez J.P., Bodin L., 2019. Effect of feed restriction on the environmental variability of birth weight in divergently selected lines of mice, Genetics Selection Evolution, 51: 27. DOI: 10.1186/s12711-019-0471-9
- Herrera-Cáceres W., Ragab M., Sánchez J. P., 2019. Indirect genetic effects on the relationships between production and feeding behaviour traits in growing Duroc pigs, Animal, published online 1 October 2019, 10 p.. DOI: 10.1017/S1751731119002179
- Le Sciellour M., Zemb O., Hochu I., Riquet J., Gilbert H., Giorgi M., Billon Y., Gourdine J.-L., Renaudeau D., 2019. Effect of chronic and acute heat challenges on fecal microbiota composition, production, and thermoregulation traits in growing pigs, Journal of Animal Science, 97 (9): 3845–3858. DOI: 10.1093/jas/skz222
- Messad F., Louveau I., Koffi B., Gilbert H., Gondret F., 2019. Investigation of muscle transcriptomes using gradient boosting learning machine identifies molecular predictors of feed efficiency in growing pigs, BMC Genomics, 20: 659. DOI: 10.1186/s12864-019-6010-9
- Mignon-Grasteau S., Beauclercq S., Urvoix S., Le Bihan-Duval E., 2020. Interest in the serum color as an indirect criterion of selection of digestive efficiency in chickens, Poultry Science, 99 (2): 702-707. DOI: 10.1016/j.psj.2019.10.005
- Nguyen-Ba H., Van Milgen J., Taghipoor M., 2019. A procedure to quantify the feed intake response of growing pigs to perturbations, Animal, published on 23 August 2019, 8 p.. DOI: 10.1017/S1751731119001976
- Ottosen M., Mackenzie S., Wallace M., Kyriazakis I., 2019. A method to estimate the environmental impacts from genetic change in pig production systems, Int. J. Life Cycle Assess., 14 November 2019. DOI: 10.1007/s11367-019-01686-8
- Piles M., Marti J., Reixach J., Sánchez J.P., 2019. Genetic parameters of sow feed efficiency during lactation and its underlying traits in a Duroc population, Animal, 25 November 2019. DOI: 10.1017/s1751731119002842

The 6 Feed-a-Gene factsheets are available!

www.feed-a-gene.eu/media/factsheets

Upcoming conferences

Feed-a-Gene researchers will present communications in the following conferences in 2020.

7th Mediterranean Poultry Summit

25-27 March 2020, Cordoba, Spain

6th International Conference of Quantitative Genetics

14-19 June 2020, Brisbane, Australia

World Rabbit Congress 2020

1-3 July 2020, Cité des Congrès, Nantes, France

EAAP 2020

31 August - 4 September 2020, Porto, Portugal

LCA Food 2020

13-16 October 2020, Berlin, Germany

Feed-a-Gene

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Feed-a-Gene Newsletter #5 March 2020

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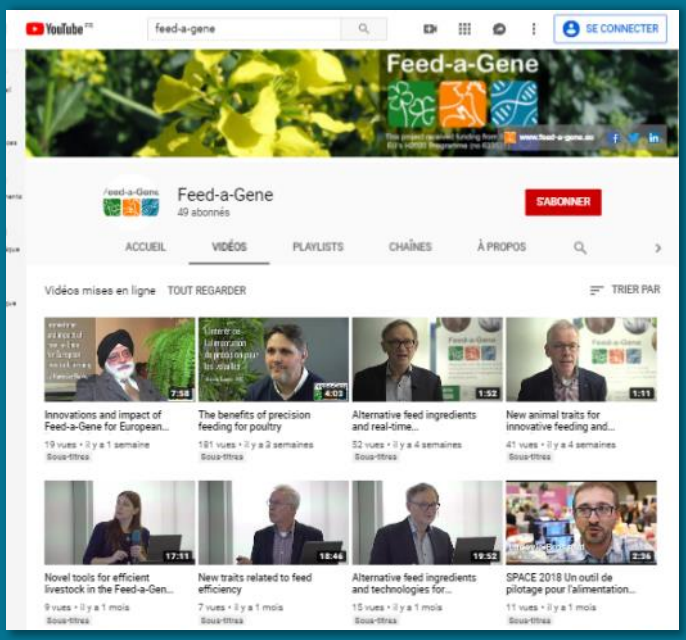

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Minutes of the stakeholder meeting and of the two demonstration events

Annex to Deliverable 7.8

Feed-a-Gene, Association française de zootechnie, 25 February 2020

Feed-a-Gene events since June 2019

Since June 2019, the following Feed-a-Gene events (workshops and demonstrations) have been organized in Europe.

- Demonstrations and presentations of precision feeding for pigs (WP4), Italy, 10 April 2019, 7 June 2019, 3 February 2020
- FEFAC seminar: European protein autonomy - more and better (WP1), 8 October 2019, Copenhagen, Denmark
- Animal Task Force seminar: "What research and innovation can deliver to support climate mitigation and adaptation in livestock farming?", 6 November 2019, Brussels, Belgium
- Feed-a-Gene: 5 year advances for breeding towards improved feed efficiency (WP2-WP5), 12 December 2019, Wageningen, Netherlands
- Feed-a-Gene Final meeting, 22-23 January 2020, Rennes, France.
- The 52ème Journées de la Recherche Porcine (4-5 February, Paris, France) was in part dedicated to Feed-a-Gene, and all WP were represented by presentations (7) and posters (3).

This document presents:

- The Final meeting, which was a stakeholder meeting
- The demonstration session of the Final meeting
- The WP4 demonstration and events in Italy
- Flyers of stakeholder meetings and demonstrations

The Final meeting included a workshop dedicated to sustainability, for which minutes are provided in Deliverable D6.6. "Sustainability Appraisal Workshop", which is not included here.

Final stakeholder meeting, Rennes, France

Overall description

Figure 1. Hôtel de Rennes Métropole, Rennes,

On 22 and 23 January 2020, the Feed-a-Gene project held its final meeting at Hôtel de Rennes Métropole in Rennes, France. The aim of the meeting was to present the results of 5 years of research addressing key issues for the future of monogastric animal production. The meeting lasted 1.5 days.

The Hôtel de Rennes Métropole is the administrative centre of the intercommunal structure based in the city of Rennes, in the Brittany region. The plenary sessions were filmed and can be watched here: https://www.youtube.com/channel/UCfjCBWHDOYLo1N_V60aWNPA/. The presentations and posters shown during the conference can be downloaded from here: https://www.feed-a-gene.eu/news/feed-a-gene-final-meeting-factsheets-presentations-posters-and-videos

Audience

The audience consisted in 146 participants from 11 countries. 68% of the participants were from French organizations.

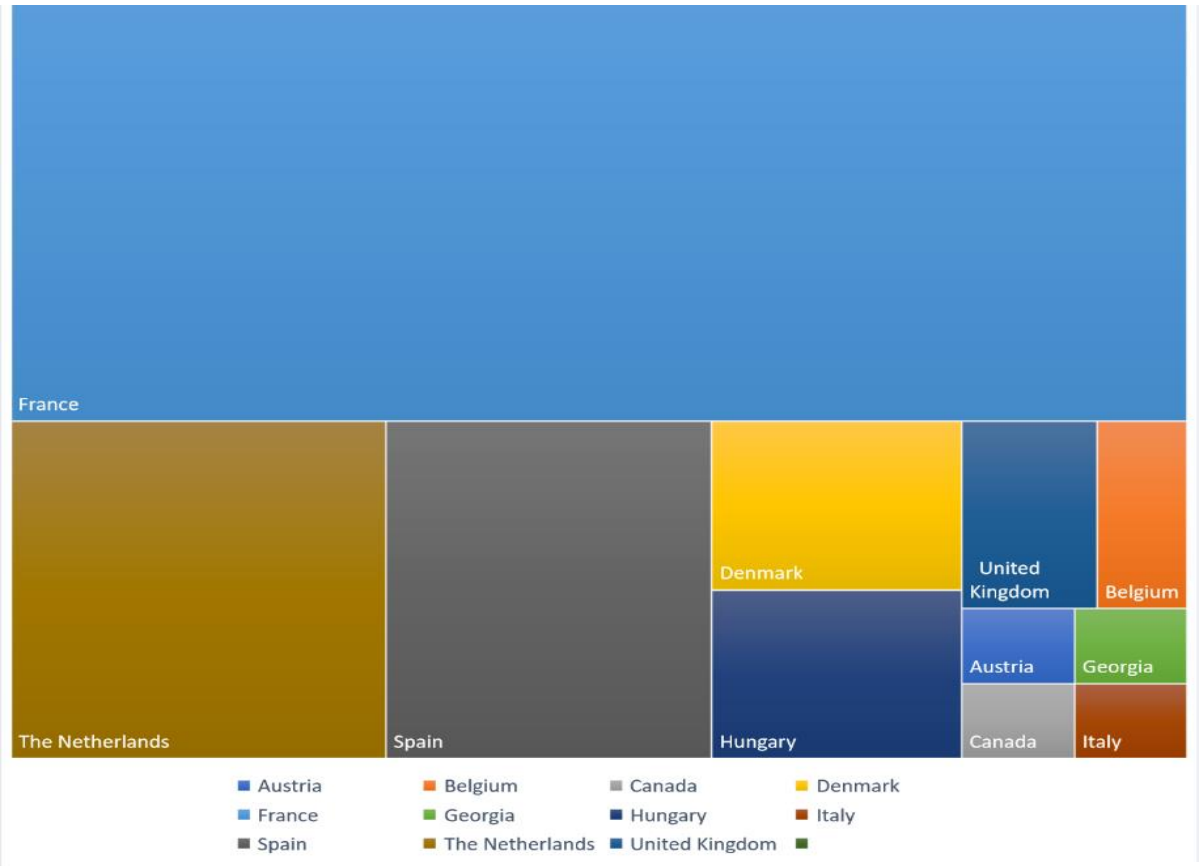

Figure 2. Audience of the final meeting per country

Half of the participants belonged to R&D organisations or academic institutions that were, for most of them, partners of the Feed-a-Gene consortium.

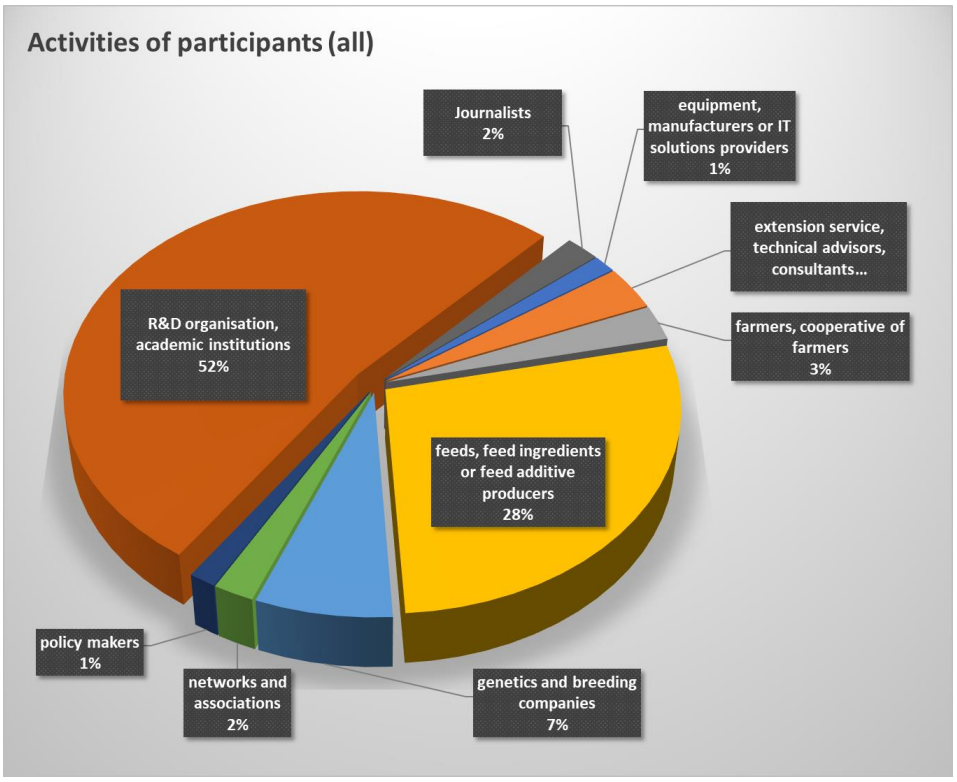

Figure 3. Activities of participants including members of the Feed-a-Gene consortium

More than 60% of the stakeholders from organizations outside the Feed-a-Gene consortium came from the industry (e.g., feed industry, genetics, equipment).

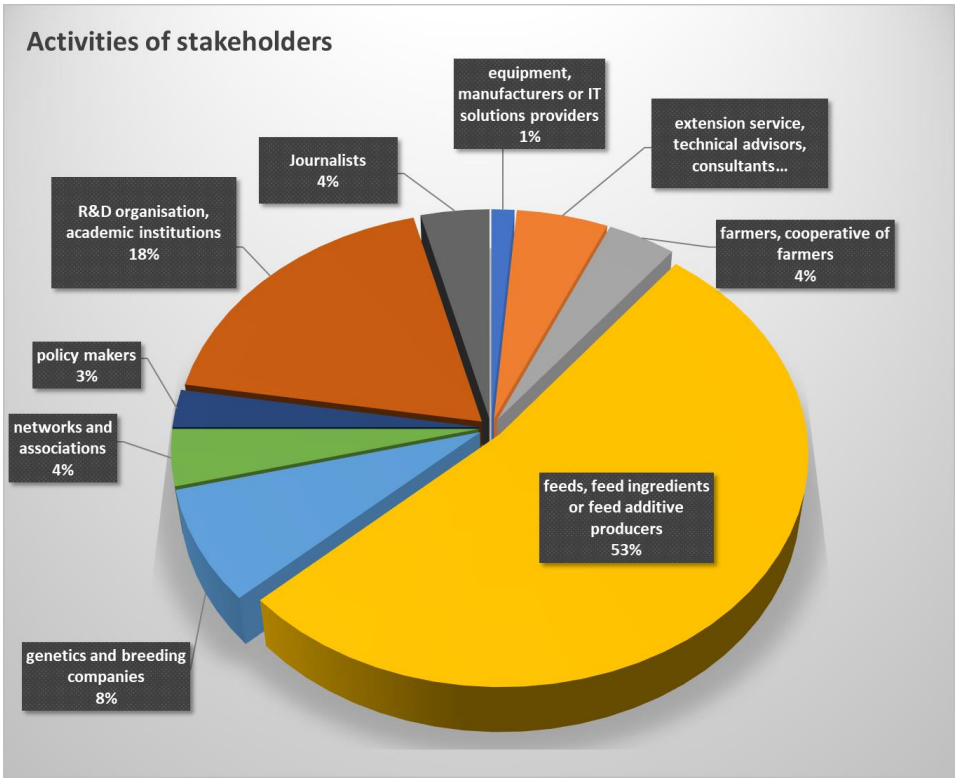

Figure 4. Activities of participants NOT including members of the Feed-a-Gene consortium

Meeting programme

The meeting programme consisted in 4 main sessions.

First plenary session (22 January)

The meeting was opened by Isabelle Pellerin, vice-president of Rennes Métropole.

Figure 5. Jaap van Milgen's introduction of the final meeting

The first keynote speaker was project coordinator Jaap van Milgen (INRAE), who reminded the audience of the scientific objectives of Feed-a-Gene, and then focused on the aim of the final meeting: going from research and innovation to impact on the society.

The second keynote speaker was Jean-Charles Cavitte (EU DG Agriculture & Rural Development), who described how the EU was funding research on livestock production and introduced the next research and innovation framework Horizon Europe, that will start by the end of 2020.

The six Work Package leaders made short presentations of the results and outcomes of Feed-a-Gene. These presentations dealt with:

- The search for European protein autonomy (Knud Erik Bach Knudsen, AU)
- New animal traits for innovative livestock management strategies (Alfons Jansman, WUR)
- New traits and models for animal selection (Hélène Gilbert, INRAE)
- FeedUtiliGene software to demonstrate modelling of biological functions (Veronika Halas, KU)
- Innovative feeding technologies to improve feed efficiency and reduce the environmental impact (Jesús Pomar, IRTA)
- Evaluating the sustainability of new approaches to livestock feeding (Guy Garrod, UNEW)

Demonstration session

After the lunch, the participants were invited to the Discoffeery™ session, which was a session organized around five demonstration areas where they were able to discover the results of the project through interactions with Feed-a-Gene partners. The demonstration areas included booths, laptop presentations, software, videos, posters, and equipment prototypes.

A detailed description of the Discoffeery™ session is provided in the second part of this document.

Figure 6. Demonstration area

Thematic workshops

After the Discoffeery™ session, the stakeholders were invited to participate in four workshops where they were asked to think about the applicability and exploitation of Feed-a-Gene results through a SWOT analysis. Feed-a-Gene facilitators gave their thoughts about Strengths and Weaknesses of their research and asked participants to provide their views on the Opportunities and Threats that such results could yield.

Figure 7. Workshop session

Four thematic workshops were held:

- New feeds and processes and nutrition: protein supply, nutritive value assessment
- Big Data and modelling
- Genetics and breeding: new traits/bioindicators and breeding schemes
- Novel feeding technologies: precision feeding

The results of these workshops were presented during the plenary session of 23 January.

Final plenary session (23 January)

The final plenary session was divided in three parts.

- A sustainability appraisal of the results obtained by the Feed-a-Gene project, presented by Guy Garrod
- A wrap-up session where the conclusions of the thematic workshop were exposed and discussed.
- A round table: Which future for livestock production?

Figure 8. Presentation of the Sustainability

The minutes of the sustainability appraisal can be found in the Deliverable D6.6. “Sustainability Appraisal Workshop”.

The minutes of the round table are provided below.

Figure 9. Final group picture of the meeting participants

Minutes of the round table: Which future for livestock production?

Transcript

Jaap van Milgen (project coordinator, INRAE): You have seen that Feed-a-Gene is a large project, we have touched on many elements of livestock production on different levels, and one thing that I have noticed, is about communication. Not just communication within the project, not communication with stakeholders, but communication with society. What do we do? There is a lot of discussion in the press about livestock production, some of it positive, some of it negative. We can say that we reduce environmental impact, but the criticism is "you are still polluting". So how should we deal with it? Bertrand [Méda] said that we have a lot of things to communicate about. Jan [Venneman], you mentioned in the last annual meeting, that we do not communicate as a sector with the society. So how should we do that? Who wants to respond on that? How do we, the livestock production sector, deal with consumers that consume animal-based products, citizens that criticize us for what we are doing? How do we communicate with them?

Jan Venneman (Stakeholder advisory board): I have to do this! I would like to refer to the slide of Guy [Garrod] because I think it is a good start for this discussion, and I want to focus on the slides with the percentages [of low acceptance of new technologies including precision feeding]. It is a shocking slide! We have to realize that. Because, if you read well, the percentage – it is not necessary to read between the lines, it's really there – if you look at what the society thinks, there is no space for precision feeding and there is no space for precision breeding. And this is really shocking. I can promise you: if we do not do anything on it, it is getting worse. The percentage will be lower. We all have to do this communication. Not everybody is in the same position to do this kind of communication but everybody can play a role. At least to talk about it around the coffee machine, with your colleagues. We would like Guy to send to all of us this specific slide, to translate it into your own language, and show it everywhere. Everybody should focus on it. The society does not want precision feeding, does not want precision breeding, how can we change this attitude? Discuss it with your colleagues, because if we all discuss it, then people in industry and the farming sector, because they have to take the lead, then they can pick it up and try to find communication messages to the society, to improve the situation.

Knud Erik Bach Knudsen (Aarhus University): The question is that maybe it is because the consumers do not really understand what precision feeding is all about. Is precision feeding that different from using robots to milk cows? A least in Denmark, I have never heard anybody or consumers opposing using robots for milking the cows. And the reason maybe is that it is not quite as common now as it was 10 years ago – that is more because of economic reasons, because in the end of the days, due to the size of the farms, it may be not as economical as it was thought to be – but I have never heard any consumers opposing the use of robots actually.

J. van Milgen: What happens if you tell them you milk cows by robots?

K.E. Bach Knudsen: Well it has at least been on television. We are quite open. In Foulum we are inviting people to our research facilities, and I have never seen in the news anything that is specifically negative about that. It is negative for instance about GMOs and things like that. And because we want to have things more natural, you also see an increase in the sales of

organic food but the organic milk, it is also milked by robots. So I think it is because we have never been able to communicate to a larger extent.

Michael Aldridge (WUR): I think it should be more grassroots education-focused. We all write articles for journals, and it may be a press release related to that that our institutions provide, but the general public is never going to read those papers, it is going to be the other scientists in this room that read it. So I think we need to make more of an effort, use social media and these other forms of communication to present that whole research, explain it in a layman's way to the general population. And that is our responsibility, not the media's responsibility.

Etienne Corrent (Ajinomoto): Perhaps we should not focus too much on the tools, on the way we do things, but on the value we bring to the society, to be very clear on the common sharing and understanding which value we bring, to communicate on the value of that – I am not talking about Euros – I talk about the environmental values, etc. to make these values clear, to show this is the way to go.

Pierre-Andre Geraert (Adisseo): In agriculture today, precision treatment, application of fungicides, pesticides, it is more and more developed. I was surprised by the comment of Bertrand [Méda] about geek farmers. But today when you go on the field, you see tractors with lots of GPS systems and so on, to treat precisely, so maybe we did not ask the right question, maybe precision feeding does not mean anything, what they want us to have safe food, to have good food and so on. But when we talk about communication, I think we forget to educate people. We should start from primary school, today I am always afraid when I visit schools, by the way the teachers consider that the food is done and prepared. We should be involved, [educate children when they are] 5-year old, at the beginning. Look at the books today, even in French schools, when we have a book to educate people on farming, you see a lady giving some grains to a couple of hens! But it is not the way we grow food! We need to be involved since the early age, that's all. But precision feeding, do not ask this question to people. Your car is automated, everybody is accepting that, so I think it is not the question. But the good point is the return on investment.

J. van Milgen: Is there a difference between using these technologies for the car and even for crop production compared to what the society sees for animal production? Why don't we show animals in a cage? Because it would probably be shocking for the citizens to see that. Isn't it about the citizen taking responsibility of "We want to eat meat, we want to eat animal-derived products", except also that it will have to be produced in a way, not by a small girl picking eggs, no, it is done differently. A distance has been created between citizens and consumers over the past years. We should work on trying to make consumers and citizens be the same actor again, not having an opinion in the evening, and filling his caddie when he is doing shopping. But we are not doing it, as a sector, we are not communicating about it.

Jean-Charles Cavitte (DG Agri): I would like to come back to one earlier comment about the value of what is done for the consumers and the citizens. If we communicate about feed efficiency, it does not ring a bell with the consumer. If you think of precision feeding, we can demonstrate with data, with impact, that this helps the animals to get what they need for feed and health and welfare: this is something that you can more easily communicate about. Feed efficiency, if you can demonstrate that by using this and this alternative, proteins for instance, you can reduce the impact on environment then, this is the thing, the value of what you do. For the moment what I see from the project is that the added value will be relatively small, based on what is there for the moment, so it is difficult to communicate on this. I think the

consumers are not stupid, they can understand certain things, but in a language that they are interested in, that they can understand, and with figures. So all your work about biomarkers and this kind of things, you can then put some evidence that what you are doing is just not only for the economic aspect of farming and industry etc. but bring evidence of added value to the animals, possibly to the farmers, because the social aspect is probably something that needs to be looked at, or to the whole value chain. I think these are things that could be communicated. But you need hot figures, and figures going beyond "zero-dot-something".

Masoomeh Taghipoor (INRAE): I have only a question. Whose role it is to communicate for that? We are not trained for communication. We are scientists, we can produce results, but for a good communication, efficient communication?

J. van Milgen: Who should communicate?

Unidentified audience member: NGOs are the best place to communicate about that, because they are independent and so they can communicate to the general public, they have press releases, they have communication on their website, they organize symposiums or seminars, that is important. But I would like to come back to the starting point of the project: It's about sustainability. The problem is that in the general public, the place of livestock sector is in a very bad position regarding environmental impact, greenhouse gas emissions, carbon footprint, and it is not the reality. So first, scientists, you are researchers, you have the numbers, you have the figures, you have to communicate about the right numbers, on the greenhouse gas emissions, the carbon footprint, of the livestock sector, and it is much lower than it is in the general public's mind. Second, you have a very important project, maybe you can say that you have very small results but the aim is to decrease the impact of the livestock sector on the environment, and so improving sustainability and to feed people, so it means that you have to intensify the livestock sector but in a sustainable way. It means you do not take more land, you do not increase the greenhouse gases, you do not increase the carbon footprint, you decrease it because you have the solution. But you have to intensify because you do not want to increase the land use, so that is important. So, you have the NGOs to communicate, you have the right numbers, the right figures, you have to convince the general public that livestock sector is not a problem but is part of the solution. The livestock sector is part of a circular economy, which is the main goal of the EU, of the EU Commission, it is in the last resolution. So that is also very important to push in this direction.

Veronika Halas (Kaposvár University): If we want to convince people, probably we should communicate, but if we started by ask them first what the problem, what is your problem with this specific technology. Then we will be more efficient in explaining. Because I think that most of the problem is coming from the lack of knowledge, that we talked about. There is no education, there is no real knowledge for the very small children, at the primary school. Later on, if you do not go to an agricultural university, nobody knows about the food and how the food is made. But we do have a lot of terrible videos showing that all the animals are suffering, and we are more emotional about animals. But I think that would be very efficient to ask them "what is the problem?".

J. van Milgen: Returning to the question of the global challenge. Why can't we use Brazilian feeds when we use Taiwanese televisions? So how does that global challenge fit into the European solution that we look for? The "not-in-my-backyard" approach is of course also present for livestock production. Environmental pollution is of course more of a problem here than it is [elsewhere] – I would not say Brazil because deforestation is of course a problem in

Brazil. There is some kind of denial of the problems, it is less a problem if it is abroad and far away than if it is local. So how should be deal with that global challenge and solutions that have to be found in Europe? Can we rely on Brazilian soybean? I can do without television for two weeks, but I cannot do without food for two weeks, so is there a food security problem relating to that? If we want to eat, we have to produce and to accept the consequences of what we produce in terms of environment, in terms of animal welfare. Do we look on our T-shirt where it was made? Have you looked if your shirt was made in Bangladesh, by children?

Jean-Yves Dourmad (INRAE): Just a short comment when you compare protein imports with televisions. We have seen on a slide that 70% of the protein-rich ingredients we use in our diets is imported, I think perhaps it is slightly less in the recent years, but this does not mean that 70% of the protein in the diet is imported! It is about 10% only, so we only import 10% of the televisions, if we compare it with this. When we report import of protein, we report import of protein-rich ingredients, but the largest part of the protein that we use in Europe is produced in Europe, and we have to tell this. because the public thinks we import 70% of the feeds to feed our animals and it is not the case. It's a problem of communication for us also.

J. van Milgen: A lot of protein we use comes from cereals.

Leo den Hartog (Stakeholder advisory board): We are in very challenging time frame. When my father was born there were 2 billion people to feed, when I was born there were 3, and now we have 7 and we go to 9, and all people need food. And actually we have two main points. Do we have the resources and how do we reduce the emissions? And this is what we do with precision nutrition. The resources, we say we should produce everything in Europe. But as Paul [Bikker] said "Local is possible but global is necessary" because soybean is still a very good source and we have to look for alternative for sure, but the protein is good, it is highly digestible and the nitrogen/phosphorus ratio is also good. If we produce in Europe, then it is less digestible then we have more pollution, so that is something we have to think about.

And there is a lot of focus now on emissions. In the Netherlands, nitrogen is under discussion, greenhouse gases also, and we have to focus on this. The second is that nowadays there is a change in animal production. One quarter of the pig population is killed at this moment because of the African swine fever. China is now investing 7 billion to bring the pig production back in China, and they will use face recognition and all new technologies. In the five coming years, pig production from Asia is again on the radar. This has an impact. So we have time to make concepts with the retail in Western Europe.

So you see that circularity is also in discussion. The documents from the ministry in the Netherlands is focusing on non-edible raw materials. It means that in the future, feed conversion ratio of raw materials might be worse when we use all raw materials, and we have to think what we do, because there is tension between welfare and environment. That is where scientists are necessary. Another point is that health is key, because if I look on a global level, the production of our animals stands to 40% and even 50% below the genetic potential because of subclinical infections, so with the existing animals we can do much better.

Then we talk about society perception. Jan [Venneman] was right, when I saw the slides from Guy [Garrod], what was on top, helping animals with equipment to give them food all day. It looks that the perception is that they do not have food all day, and on the lowest, the tools to monitor health and feeding, that means that they think about industrialisation, when we say, as scientists, "Hey, this is a great way forward, also for welfare", but that is the perception [of the general public].

One last thing, when I was in Bangkok presenting at a global feed and food conference. The global players were there, they said there are two big elephants, one is Asia and one is Latin America, and there is a nasty fly which is Europe, which is bothering, always talking on new items coming up. They say the future will be decided in Beijing, in Jakarta, in Delhi, not in Brussels, that is the perception now. We were leading as Europe for a long time, but now we see other parts of the world who say "Wait a moment, we all have the rights", and so on. And that is what we have to think about in communication. We had a project in my company, we made a presentation, and everyone had to go to the school with their kids, or their grand-children, and present animal production. The people loved it, and the schools and the kids loved it. And we now have an organization "MeatTheFacts" in the Netherlands, and they looked at the books of the primary school, and only one book was right, the all were all very far behind and not true about what was presented. And therefore I think we have to think, as Feed-a-Gene, when we spent 10 million of tax money, what should we communicate to the society, what can we say to people who have no clue about animal production about what we delivered, and that would be an opportunity to have press releases on Feed-a-Gene.

I think it is a challenge for all of us to do this because we did great work, but if you talk on precision feeding, people say "Yeah, that is robotized" and so on. Yesterday at dinner we had a discussion and in France, some people say artificial insemination is rape. I saw a press release from PETA, they say to the feminists "Do not eat egg or drink milk anymore because these are from female animals that were forced to produce". You see that this kind of news is coming and we have no answer. We have an answer, but we do not communicate. In the Netherlands, we have scientists, but the other side they are all in the press, and people do not know who to believe. We should focus now, in the last months, on communication to the broader public.

J. van Milgen: Are we organized to do that?

J. Venneman: No.

L. den Hartog: We have the ingredients, we have to be realist as there is always part of the public who do not believe them or put arguments against it. Now in the Netherlands, they talk about mortality, they say 15% piglets will die. This is a very bad message and the government says that we have to monitor this and so on. So, there are always negative elements. But we should not be afraid of that. We should start the discussion because if you look at the life cycle analysis, one-third of our protein intake should be from animal protein in order to use the global resources in an optimal way and this is excluding fish. With fish it is even more. So I think it is a great opportunity.

J. Venneman: I think the only way to do this is to do this in a structured way. We do some communication but it is very fragmented and I think that the sector, the farmers organizations, together with the supplying and processing industry, they should take the lead to create a structure from which communication can be done. The science should help them because they have a more independent role, they are more believed than the industry itself. It should be structured, it should be organized, it should be financed by the industry, because our "opponents" from the welfare organizations, they do it in the same way. If we do not do it in a structured way, it will always be fragmented. In some countries, there is some development, the Netherlands now we have an organization called "MeatTheFacts", they started to do something, also in Brussels with COPA, with some umbrella organizations like FEFAC, and FEFANA and EFFAB, they started to do something. Actually, "MeatTheFacts" comes from Brussels. To start something up you have to do it in a structured way.

Galyna Dukhta (Kaposvár University): I have a reaction. I am listening as a PhD student. Once I had a roommate, she was Indian, she told me that there is a possibility that all people could be vegetarian. It is nice, why should we kill animals, you can be a vegetarian. It is a nice life, because she was born in India, and I say "If you were born in Siberia, you would have no choice to be vegetarian". So it is one aspect. Another aspect is that we are all consumers, and at the end of the day, we are going to shop, what do we choose in the supermarkets? Before I started studying agriculture, I thought that the milk was from the shop. About using the robots, using the milking equipment for the cows. As scientist we have to find points of collaboration between different disciplines, we have to find ways to decrease the errors in industry. We use milking robot to increase food safety. We have to find a balance. As humans we have to find ways to increase production and increase safety with less environmental impact while producing more income for the producers. But who is responsible? We have consumers, we have industry, someone has to balance.

J. van Milgen: Who is responsible?

K.E. Bach Knudsen: We as scientists are naturally responsible for communicating. We are working with clients to develop sustainable feeds, that fits reasonably well with the trends we have at the moment. I completely agree with what has been said about the animal sector that is challenged. You see a trend towards people taking more vegetarian food, you see clearly for instance that in the US there is a decrease in the consumption of milk, and we are probably going to see the same in Europe. And we should not forget that European population is declining. We are older than the Asian population. There are some trends we have to cope with.

Alfons Jansman (WUR): If we look to the future, would it be better, rather than allocating value for society at the end of the project, and to consider sustainability and welfare at the end of the project, to change our minds and to start when we define and develop a project with discussing what do we contribute to what society is expecting from us? So to take on board a new group of stakeholders, which are now sometimes forgotten and only involved at the end – we want to communicate to them – but could we take them on board to help define our future projects.

Candido Pomar (Agriculture Canada): I think today we are in a very difficult moment in terms of communication. We are in the era of the fake news. A lot of fake news is going on. Most information that is going on in animal production is fake, is not good. We are changing also the way we are communicating. Actually, the social media is a very important way of communicating. The population also is more and more disconnected from agriculture, so their conception on how we produce cereals or animals is completely disconnected. In some places you go to the school, you ask the kids where the milk comes from, and it is "from the grocery". They do not know there is a cow in some place. So the question is "If we have to communicate, who has to communicate?" We are scientists, we are working in the sector, and I think in this situation we need more professional people who are going to communicate. Maybe the institutions should have to put money just to get the right information through the right media. Otherwise I do not think that from our side we are going to be able to bring that. If we had to do to the final objective in relation to what the society thinks, this is going to be very difficult, because the thinking of the society is very often based on fake news.

J.C. Cavitte: About the multi-actor approach: Usually we have different sectors of professional people and now we always have a question whether we should put the representatives of

citizens, or NGOs in. The question is whether the consortia will be happy to have NGOs in the consortia, because then it is something that has to be considered. We are wondering whether when we write our topics we should say "yes", the project should also include representatives of civil society in this kind of things. The question is then how you manage it during the life of the project.

Coming to fake news, communication etc., we are all responsible for communicating. At least in DG Agri and DG Research there is the EIP service point, Horizon 2020 News, you can write success stories, you can publish them etc. There are also ways for researchers to be educated and trained in communication. In big projects we had in FP6 and FP7, there were summer schools, some training within the projects to educate people, institutes and entities for communicating results.

Probably we do not communicate enough. One thing for instance, if we look at antimicrobial resistance and the use of antimicrobials in the livestock domain, what you hear is still that the use of antimicrobials in the livestock sector is the reason for the 40,000 fatalities in humans in Europe or in the world. But we should communicate that already for the last years, the use of antimicrobials in veterinary medicine has decreased tremendously. So this is a success, maybe it is a bit difficult, as people may say "Hey, why the hell did you use so many antimicrobials before then?". But we have to present it in a positive way. When I read papers about successes, the fight against antimicrobial resistance, they are usually published from the public health sector, and I read a paper recently, the only example they could give of a success they actually had taken the data from the veterinary sector. There are ways to communicate things. You need evidence, you need facts, you need figures that show that it is not only a marginal impact, but something substantial, and I think there is a case to improve your communication.

Bertrand Méda (INRAE): I fully agree that science should provide facts, numbers, figures, whatever you want, to communicate, to show that livestock or agriculture is good. I think there is a huge problem, which is the trust that people have now, or lack, in science in general. You have more people thinking that global warming is not true or [think that a molecule is dangerous when] you show that this molecule, this pesticide, is not dangerous for human health. Even though you make good science, with a scientific independent approach, the problem today is that there are more and more people challenging science. "Scientists are not independent anymore", "They work for private companies", you know the stuff.

J. van Milgen: Is the future or livestock production bright, dim, dark? How do you see that? What colour do you give to the future? It is challenging, that we agree upon.

Delphine Melchior (Cargill): To go back to the communication, there is one thing very important that we need to do when we communicate. It is really to say that what we know today, accepting that we do not know everything, and being able to explain things in a futuristic way, without looking like people that are defending what has been done. So it means that we have to be very factual today in the domain of agriculture and animal production. We have to say that we have done things that were not good. We have done things that were really good, and we now believe that what is going to impact the future is "this", and we need to be very clear on that and very open. When I look at the future, where I see some energy and positivity – and I think that we underestimate that when we talk, – is the capacity of a lot of people to invest in agriculture. There are people who were not in that domain, in business schools, that are really investing, the insect companies in France are a case of that. There are

many others, new technologies to reduce methane for example, where people are really investing, and people that were not necessarily coming from agriculture, and they come in that domain because they think there is a strong meaning in being in agriculture and in food production. For me, this is where the positive signs are. That there are lots of things that can be done on the technology. And the people who were not necessarily in the farming area, to say "I am going to stop working for this food company, and I am going to start working for an agriculture company because I really believe in it". It is not "Everything is bright", but there are positive signs that I see.

L. den Hartog: We make our own future. In the Netherlands we often talk about the golden triangle: industry, science, and policy makers (the government). For Europe, you really have to team up together, so science is extremely important for the facts, for the new technologies and so on. Industry should take the lead in implementing and communicating. And the government and the policy are also important. There are some issues now: they talk about farmers' income. All over Europe, farmers' income is an issue, and then they say they do not get a fair price, we have a lot of discussions about this. There are two things extremely important. First, policies are not consistent. They change, it is not clear how can you invest when policy is changing. The second thing is the level playing field. The point is that the level playing field is not fair, because we prohibit battery cages in Europe but we import eggs from Ukraine to use in cakes and biscuits. We are not allowed to vaccinate, but we import meat from Argentina. We are not allowed to use meat and bone meal, but we import products from outside Europe that have received meat and bone meal. We have the Mercosur deal, we have the deal with Ukraine. So that is on the policy makers side and it is very hard to compete with this.

I think for science, the important thing is that we have to make an integrated approach. I had to make the sustainability agenda on poultry for the Dutch ministry. We prohibit the battery cages but the biggest issue now is fine dust, the dust particles. It increased to twentyfold by prohibiting the battery cages, and we have a conflict between welfare and environment, and we have to show the dilemmas, and [the policy makers] have to choose.

J. van Milgen: You have seen in this day and half what we have done with your money, basically, the taxpayer's money: 10 million €, 9 million € from the EC. It is not done, the story is not done, we should continue, what we have done in these five years. We would like you to pick that up, if you see elements in it that you can see have potential. Contact us, we are there to help. The specific aspects of the five years of Feed-a-Gene can be picked up by you if you see a potential interest, and we can make these things work.

I would like to thank, first of all, all the Feed-a-Gene partners. There were 23 partners, but many people contributed to that, I think we can give all these people a round of applause for their contribution to five years of community funding. And I would like to thank you as well, there was a very good turnout, and we are very pleased that you showed an interest, and you see perhaps a potential in what we have done.

Main messages

About communication

- There is a growing growing disconnect between the general public and livestock farming, fuelled by a lack of knowledge about agriculture and by the dissemination of incorrect and sometimes intentionally misleading information ("fake news").

- The participants agree that communication towards the general public is key to fight this trend.
- Communication should be structured and involve the industry, scientists, and policy makers at government and EU level.
- Communication should be handled by communication specialists and organizations such as NGOs that have their own communication networks. The EC has also its own channels for that. Funding will be necessary.
- Everyone in the sector can play a part, including scientists and industry professionals, who can for instance talk about their work in schools. Training in communication should be provided if necessary.
- Communication should target the general public, starting in primary schools. It should use the same tools as those used by critics of livestock farming, particularly social media.
- The message should use accessible language, as well as facts and figures to emphasize the values and positive impacts brought by livestock farming, making it part of the solution rather than a problem.
- The sector should be very open about itself. It should highlight the positive – ongoing changes or past realisations – without ignoring negative issues.
- Future research projects should involve members of the civil society, such as NGOs, from the start. This would allow to include in the project the questions that are deemed important by these stakeholders.

Ideas about the future of livestock production

- The sustainability may be seen in a different way if you consider European or global sustainability.
- On a global scale, soybean is more sustainable than alternative protein-rich feeds and the imports for feeding are not as high as the society thinks.
- There is a tension between animal welfare (which requires more space for instance) and environmental goals (less land use). Scientists are necessary to provide solutions to this issue. Likewise, improvement of environmental conditions or animal welfare should not be detrimental to animal health or human health.
- Animal health may improve overall global productivity, the production stands at 40-50% of the genetic potential because of infections etc. Improving health will improve productivity.
- European leadership is likely to decrease in the next years due to the importance of super-actors in Asia and Latin America.
- These are challenging times for animal production (health issues, growing opposition from part of the public for ethical or environmental reason) but there are also positive points: one-third of human protein intake should come from animal products to better use global resources.
- Some new industry players are investing in the business of animal production and are committed to improve the image of animal production (e.g., circularity, environmental friendliness)
- It would be good to have consistent, stable policies at national or supra-national level and to have rules that are not detrimental to European farming in that they compel them to comply with standards that foreign countries are not required to respect (e.g., eggs coming from Ukraine, meat from Mercosur)

Demonstration event of the final meeting

The Discoffeery™ session was a demonstration event that took place during the final meeting. Five areas of demonstration activities were set up in the lobby of the Hôtel de Rennes Métropole. The idea was to allow stakeholders to visit these areas as they would have done during an exhibition: visiting booths, discovering products or services, and discussing with Feed-a-Gene partners. The session lasted 1h30 and the exhibition area remained open during the whole meeting.

Demonstration activity about European protein autonomy

The area was dedicated to the presentation of research about alternative feed ingredients and real-time characterisation of feeds (WP1). Staff from Aarhus University, IFIP, IRTA, Terres Inovia, and Wageningen University were on site to discuss with the participants. The demonstration area included the following elements:

Demonstration

A booth where samples of green protein, processed soybean meal and processed rapeseed meal were presented.

Figure 10. Raw, coarse, and fine fractions of rapeseed meal exhibited on the WP1 booth

Presentations (4)

The following presentations were shown on the laptop installed on the booth.

- Nutritive value of green protein, Søren Krogh Jensen (AU)
- Nutritive value of European soy fractions, Veronika Halas (KU)
- Nutritive value of fractionated rapeseed meal, Paul Bikker (WUR)
- Evaluation of nutritive value of feeds by NIRS, Samantha Joan Noel (WUR)

Figure 11. Laptop showing the evaluation of nutritive value by NIRS

Posters (6)

- Royer et al., 2020, Processing of partly defatted meals from European soybeans and nutritional value for broilers and piglets
- Quinsac et al., 2020, Development of local soybean production and valorisation for animal feeding in France
- Jensen et al., 2020, Protein from green biomass as a sustainable protein source for monogastric animals
- Bikker et al., 2020, Fractionation as a method to improve the nutritional value of rapeseed meal

- Melo et al., 2020, The influence of rapeseed meal upgraded by bioprocessing and enzyme supplementation on growth performance and nutrient digestibility in pigs
- Noel et al., 2020, The development of models to predict the nutritional value of feedstuffs and feed mixture using NIRS

Demonstration activity about new traits/bioindicators and breeding schemes

This area was dedicated to the presentation of research about new animal traits for innovative feeding and breeding strategies (WP2-WP5). Staff from INRAE, IRTA, Topigs Norsvin, University of Lleida, and Wageningen University were on site to discuss with the participants. The demonstration area included the following elements:

Demonstration

A rabbit cage (with plush rabbits!) equipped with an experimental feeder able to record individual feed intake was installed in the booth.

Figure 12. Rabbit cage with individual feeder

Presentations (5)

The following presentations were shown on the laptop installed on the booth.

- Demonstration of a calorimetry facility by Etienne Labussière (INRAE)
- Detailed approaches and results (list of biomarkers) to be run on computer by Florence Gondret (INRAE)
- How to get microbiota data: Standards for sampling, DNA extraction, 16S sequencing, pipelines, normalization, and OTU table by Olivier Zemb (INRAE)
- Feed efficiency prediction from microbiota, hypothesis for linear models involving host genetics matrix and microbiota matrix, further experiments by Hervé Garreau (INRAE)
- Shiny interface to illustrate response to selection by Ingrid David (INRAE)

Videos (4)

- Assessment of agonistic behaviour in pigs using social network analysis (Saif Agha et al., 2020), presented by Juan-Pablo Sanchez (IRTA)
- The poultry feed station, presented by Sandrine Grasteau (INRAE)
- Difficulties of video recording, presented by Sandrine Grasteau
- Rabbit behaviour, presented by Miriam Piles (IRTA)

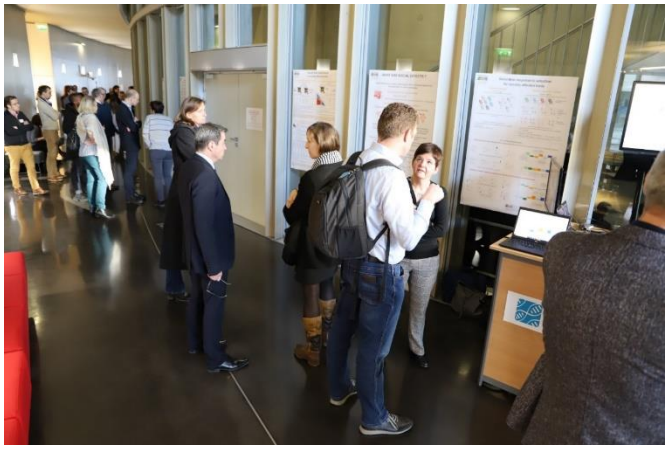

Figure 13. Miriam Piles presenting the video on rabbit behaviour on the WP2 booth

Posters (11)

- Labussière et al., 2020, New tool for phenotypic selection: predicting digestive ability of growing pigs from Near-Infra Red Spectra of feces
- Jansman et al., 2020, Effects of birth weight and genetic capacity for protein deposition on N efficiency in growing pigs
- Gondret et al., 2020, Towards biomarkers of feed efficiency using –omics approaches for biomarkers discovery
- Marin-Garcia et al., 2020, The effect of genetic type and feed restriction on the urine metabolome of growing rabbits
- Sarri et al., 2020, Fat metabolism and precision feeding
- Sarri et al., 2020, Protein metabolism and precision feeding
- Mignon-Grasteau et al., 2020, Serum color as a biomarker for indirect selection of digestive efficiency
- David et al., 2020, What are social effects?
- David et al., 2020, Results from Feed-a-Gene on socially affected traits
- David et al., 2020, Simulation response to selection for socially affected traits
- Aldridge et al., 2020, Newly proposed selection strategies for feed efficiency

Demonstration activity about modelling biological functions with emphasis on feed use mechanisms

This area was dedicated to the presentation and demonstration of the FeedUtiliGene software and of its components developed within WP3 “Modelling biological functions with emphasis on feed use mechanisms”. Staff from Kaposvár University and INRAE were on site to discuss with the participants. The demonstration area included the following elements:

Demonstration and presentations (5)

The presentation of the FeedUtiliGene software consisted in a live demonstration of its different modules on a laptop:

- Digestive model, presented by Veronika Halas (KU)
- Nutrient partitioning model in pigs, presented by Veronika Halas
- Nutrient partitioning model in poultry, presented by Galyna Dukhta (KU)
- Perturbation module, presented by Hieu Nguyen Ba and Masoomeh Taghipoor (INRAE)
- Stochastic module, presented by Veronika Halas

Figure 14. Veronika Halas showing the FeedUtiliGene software

Video

- A video describing the FeedUtiliGene software was shown on a 43" screen and presented by Veronika Halas

Posters (6)

- Halas et al., 2020, FeedUtiliGene: Nutrient partitioning modules to understand feed use mechanisms in pigs
- Dukhta et al., 2020, FeedUtiliGene: Poultry Model
- Nguyen-Ba et al., 2020, A model to quantify resistance and resilience capacities of growing pigs in response to perturbations
- Gaillard et al., 2020, Dynamic modeling of nutrient use and sows' individual requirements
- Recoules, 2020, MODIPIPO: MOdel of DIgestion in PIgs and POultry
- Filipe et al., 2020, Pen-allocation strategies for uniform weights in finishing pigs

Demonstration activity about precision feeding for pigs and poultry

This area dedicated to management systems for precision feeding (WP4). Staff from Exafan, INRAE, IFIP, IRTA, ITAVI, and Gran Suino were on site to discuss the functioning of the system with participants. The demonstration area included the following elements:

Demonstration

The precision feeding system for growing pigs was brought from Spain by Exafan and installed in the hall. It included the feeder itself, the software, and the control hardware. A real-size plastic pig made the WP4 area highly visible and attractive.

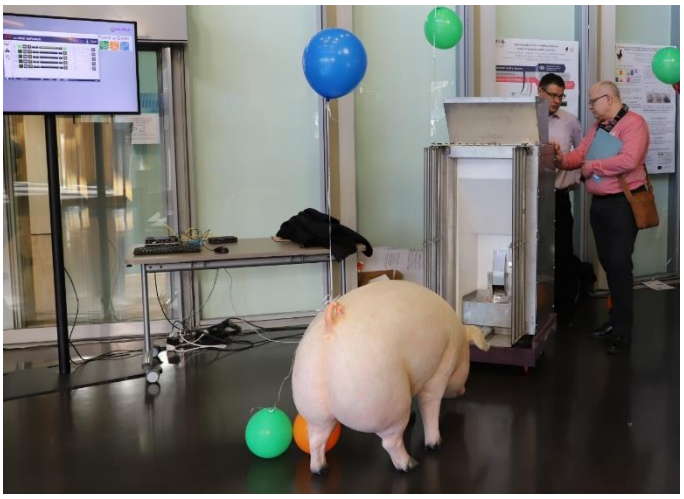

Figure 15. Jesus Haro (Exafan) explaining the precision feeding

Videos (3)

- Prototype of the precision feeding system for growing pigs (INRAE, IFIP)
- Prototype of the precision feeding system for growing pigs, and the installations at the IFIP experimental station (IFIP)
- Precision feeding system for growing pigs installed at the Campo Bo farm in Italy (Gran Suino Italiano)

Posters (5)

- Gaillard et al., 2020, Dynamic modeling of nutrient use and sows' individual requirements
- Guyot et al., 2020, Towards precision feeding in laying hens: Update of a mathematical model to predict daily calcium and phosphorus flows
- López et al., 2020, Operational precision feeding systems: main components and integration
- Quiniou, 2020, Precision feeding of restricted-fed pigs
- Jansman et al., 2020, Precision feeding in growing-finishing pigs

Demonstration activity about sustainability assessment

The area was dedicated to sustainability assessment demonstration activities. Staff from Aarhus University, IFIP, IRTA, ITAVI, CREDA, University of Lleida, and the University of Newcastle were on the area to discuss the functioning of the system with participants.

Posters (7)

Figure 16. Sandrine Espagno (IFIP), Aurélie Buteau (ITAVI) and Florence Garcia-Launay (INRAE) explaining the results of the sustainability assessment of the Feed-a-Gene innovations

- Espagnol et al., 2020, Environmental assessment of new European protein sources for feed Part 1 - at feedstuff perimeter
- Espagnol et al., 2020, Environmental assessment of new European protein sources for feed Part 2 - at animal product perimeter
- Garcia-Launay et al., 2020, Environmental assessment of feeding strategies of precision feeding in growing-finishing pigs
- Buteau et al., 2020, Environmental assessment of precision feeding used in a broiler production system
- Garrod et al., 2020, Consumer attitudes and preferences towards the new technologies: investigations in Spain and the UK
- Garrod et al., 2020, What about the farmers? A qualitative investigation of farmers' attitudes towards the new technologies
- Guesmi et al., 2020, Cost benefit analysis of new feeding techniques for monogastric livestock production systems

Demonstration events held in Parma, Italy

A precision feeding system for growing pigs fed *ad libitum* was installed early 2019 at the Campo Bo farm, a commercial pig farm in Montechiarugolo, province of Parma, Italy. The objectives were to validate the prototypes of automatic feeders manufactured by Exafan, to refine their characteristics under field conditions, and, through visits and demonstrations, to promote the adoption of this technology by farmers.

Three events were organized by Gran Suino Italiano, with the involvement of the other partners in the Work Package 4: Exafan, University of Lleida, INRAE, and IFIP. Initially, all these events were supposed to consist in group visits to the Campo Bo farm, but the outbreak of African Swine Fever that was taking place at that time forced the farm manager to limit the number of visits due to sanitary concerns. Finally, one visit was organized at the Campo Bo farm for representatives of the regional farmer's union, and 2 other events consisted in presentations held at the Chamber of Commerce in Modena to a larger audience of pig farmers.

Visit of the Campo Bo farm, 10 April 2019

The visit of the Campo Bo farm was organized for seven representatives of the Confagricoltura Emilia Romagna, the main farmer union of the Emilia Romagna region that represents 15,000 farmers and 40% of the regional farmland. Each participant represented a province of Emilia Romagna (Bologna, Modena, Reggio, Emilia, Parma, Forlì-Cesena, Ravenna, Ferrara) thus ensuring that the information was disseminated widely and in a targeted manner to the pig farmers of the provinces represented by the participants.

The visit was divided into two parts:

- A presentation of the activities carried out by the Feed-a-Gene project was organized, with a focus on the precision feeding technologies developed in WP4 and on the operation of the system (including computers and feeders). The Campo Bo farm manager, Michele Bonati, took part in the presentation and told the participants of his experience with the precision feeding system.
- The visit of the farm itself, which included a live demonstration of the operation of the feeders and a technical discussion.

Figure 17. Images of the visit of 10 April 2019

Virtual Tours of 7 June 2019 and 3 February 2020

Two meetings about the precision feeding system installed at the Campo Bo farm were held at the Chamber of Commerce of Modena on 7 June 2019 and 3 February in front of a larger audience: 38 at the first presentation and 30 at the second. The participants were pig producers and officials from Emilia Romagna.

During these meetings, participants were shown a presentation of the precision feeding system and an 8-minute video in Italian created by Gran Suino Italiano (available here https://youtu.be/nYRow_Q6Vv8) featuring interviews by Dr. Guido Zama, President of Gran Suino Italiano, Dr. Michel Bonati, manager of the Campo Bo farm, and Dra. Elisa Signorini, scientific adviser at Campo Bo.

At the end of each meeting a round table discussion was held by Vincenzo Mirra and Dr. Guido Zama.

Figure 18. Images of the meetings of 7 June 2019 and 3 February 2020

Flyers of stakeholder meetings and demonstrations

Programme

22 January 2020, Morning

9:00-9:30	Registration/Welcome coffee	All participants
9:30-13:00	**Plenary session**	Keynote speakers
9:30-10:30	Introduction by Mrs. Isabelle Pellerin, Vice-president of Rennes Métropole, in charge of Higher Education and Research	
	From R&I to Impact: Improving the efficiency and sustainability of monogastric livestock productions systems	Jaap van Milgen, Feed-a-Gene project coordinator, INRAE, FR
	EU funded research on livestock production from HORIZON 2020 to HORIZON EUROPE	Jean-Charles Cavitte, European Commission, DG Agri
10:30-11:00	Interactive coffee session between stakeholders and Feed-a-Gene partners	All participants
11:00-13:00	Presentation of the results of the project	Work Package leaders
	In the search for European protein autonomy – more and better	Knud Erik Bach Knudsen, Aarhus University, DK
	New animal traits for innovative livestock management strategies	Alfons Jansman, WUR Livestock Research, NL
	New traits and models for animal selection	Hélène Gilbert, INRAE, FR
	FeedUtiliGene software to demonstrate modelling of biological functions	Veronika Halas, Kaposvár University, HU
	Innovative feeding technologies to improve feed efficiency and reduce the environmental impact	Jesús Pomar, Universitat de Lleida, SP
	Evaluating the sustainability of new approaches to livestock feeding	Guy Garrod, University of Newcastle, UK
13:00-14:30	Lunch	All participants

Programme

22 January 2020, Afternoon

14:30–16:00	**Discoffeery session**: face-to-face discussions with explanations, demonstrations on booth. Includes posters, videos, software and other materials		All participants
16:00–17:45	**From Feed-a-Gene results to innovation**: thematic workshops on applicability and exploitation of Feed-a-Gene results from Strengths and Weaknesses to Opportunities and Threats (2 groups in parallel)		All participants
16:00–16:45	**Group 1**: New feeds and processes and nutrition: protein supply, nutritive value assessment	**Group 2**: Big Data and modelling	
16:50–17:35	**Group 1**: Big Data and modelling	**Group 2**: New feeds and processes and nutrition: protein supply, nutritive value assessment	

23 January 2020, Morning

8:30–9:00	Welcome coffee		All participants
9:00–10:35	**From Feed-a-Gene results to innovation**: thematic workshops on applicability and exploitation of Feed-a-Gene results from Strengths and Weaknesses to Opportunities and Threats (2 groups in parallel)		All participants
9:00–9:45	**Group 1**: Genetics and breeding: new traits/ bioindicators and breeding schemes	**Group 2**: Novel feeding technologies: precision feeding	
9:50–10:35	**Group 1**: Novel feeding technologies: precision feeding	**Group 2**: Genetics and breeding : new traits/ bioindicators and breeding schemes	
10:35–11:05	Coffee break		All participants
11:05–11:35	**Sustainability appraisal**: a combination of economic, environmental and social benefits		Guy Garrod, University of Newcastle, UK
11:35–12:15	Wrap-up of the workshops		Workshop chairpersons
12:15–13:10	Foresight discussion: Which tomorrow for animal productions? (Round table)		Jaap van Milgen and Work Package leaders

Feed-a-Gene

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Feed-a-Gene

5 YEAR RESEARCH FOR BREEDING TOWARDS IMPROVED FEED EFFICIENCY

THURSDAY
12 Dec. 2019
15:00-17:30

WAGENINGEN,
Radix M10

REGISTRATION
before 4 Dec. 2019:
mario.calus@wur.nl

PROVISIONAL PROGRAM:

15:00-15:25:	Alfons Jansman – "New animal traits for innovative feeding and breeding strategies"
15:25-15:50:	Mario Calus – "Overview of breeding research to improve feed efficiency in Feed-a-Gene"
15:50-16:15:	Lisanne Verschuren – "Potential role of the fecal microbiome in breeding for feed efficiency"
16:15-16:30:	Break
16.30-16.55:	Rob Bergsma – "The value of social interactions and crossbred information in selection to improve feed efficiency"
16:55-17:20:	Michael Aldridge – "New indices to improve feed efficiency in crossbred pigs"
17:20-17:30:	Closure

The seminar can also be followed live or viewed later via: https://wurtv.wur.nl/ (choose "Kanalen" on the left, and then search for "Radix M10"). Online viewers can pose questions via Twitter, tagging @FeedaGene.

WAGENINGEN
UNIVERSITY & RESEARCH

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION
HORIZON 2020

The minutes of the ATF seminar can be downloaded here:

http://animaltaskforce.eu/Portals/0/ATF/2019/FitterLivestockFarming/ATF_CDB_Press%20Release.pdf

AGRI Innovation summit 2019

H2020 Multiactor Project

Feed-a-Gene

Feed-a-Gene

Practical problem

To improve the efficiency and sustainability of monogastric livestock production systems by adapting the feed, the animal, and the feeding techniques.

Partners

The project involves 23 partners from 9 different countries, including 8 research, 9 industrial, 5 extension and 1 project management partner.

Calendar

Start: 28/07/2015
End: 01/01/2020

Budget

Total amount:
€8,999,554

Objectives of the project

Feed-a-Gene aims to better adapt different components of monogastric livestock production systems (i.e., pigs, poultry and rabbits) to improve the overall efficiency and to reduce the environmental impact. This involves the development of new and alternative feed resources and feed technologies, the identification and selection of robust animals that are better adapted to fluctuating conditions and the development of feeding techniques that allow optimising the potential of the feed and the animal. A sustainability assessment is carried out on the novel management practices aspects arising from the project.

Main activities

The project aims to develop technologies to make better use of local feed resources, green biomass and by-products and develop methods for the real-time characterisation of these feeds. Novel traits of feed efficiency and robustness allowing identification of individual variability are developed and their potential use in animal breeding will be assessed. To better understand and predict nutrient utilisation of animals, biological models of livestock functioning are developed. These models, in combination with real-time monitoring systems, are used to develop novel precision feeding systems in which animals can be fed according to their (individual) nutritional requirements.

Expected results

Monogastric livestock production systems need to rely more on alternative feed resources that are not, or less, in competition with other uses. The challenge to improve efficiency and robustness is to identify animals that do best with feed resources of poorer quality. Feed-a-Gene will provide unique solutions for animal breeding and animal management by proposing and validating heritable traits for feed efficiency, robustness and welfare (e.g., indicators of key components of gut microbiota, behaviour, and metabolomic markers of feed efficiency). Novel monitoring technologies make it possible to re-design livestock production systems in a holistic manner.

Results so far/first lessons

Feed processing technologies based on physical and enzyme treatments have been used to process European-grown soybeans and rapeseed as a replacement for imported soybean meal. Green biomass has been fractionated producing feeds that can be used by different livestock species. Promising traits, including indicators of gut microbiota composition, robustness, and social interactions have been identified and evaluated in relation with breeding for feed efficiency. A stakeholder survey has been carried out and a questionnaire has been designed to elicit consumer attitudes and preference data related to livestock production. Data have been collected for a sustainability assessment.

Who will benefit

Feed producers and cooperatives will benefit though the possibility to diversify (locally produced) feed resources. Enzyme producers can improve the nutritional values of feeds for monogastric species. Equipment manufacturer and IT companies can redesign animal housing and feeding installations to implement precision livestock farming systems. Animal breeders can use new selection criteria for a faster and more efficient selection and to exploit genetic variability among animals. Society at large will benefit through a more efficient use of natural resources with reduced environmental impact and improved animal welfare.

Supported by:

Contact: Jaap van Milgen
Mail: jaap.vanmilgen@inra.fr

Feed-a-Gene

Feed-a-Gene seminar associated with annual FEFAC meeting on:

European protein autonomy – more and better

October 8, 2019, 15:00-18:00 hours

Børsen – 1217 Copenhagen K

Programme

Alternative feed ingredients:

15:00-15:10	Progress report on Work Package 1 of FEED-A-GENE activities on new protein sources / Knud Erik Bach Knudsen, Aarhus University, Denmark
15:10-15:30	New processing technology for processing of European soybeans with high quality / Eric Royer, Idele, France
15:30-15:50	Physical separation of conventional rape seed meal for improved quality / Paul Bikker, Wageningen University, the Netherlands
15:50-16:10	Break
16:10-16:30	Protein from green biomass as a sustainable protein for Europe / Søren Krogh Jensen, Aarhus University, Denmark
16:30-16:50	Development of tools for measuring the nutritive value in real-time / Samantha Noel, Aarhus University, Denmark
16:50-17:10	Danish protein plan / Søren Krogh Jensen, Aarhus University, Denmark
17:10-17:30	Progress report on other Work Packages in the Feed-a-Gene programme / Knud Erik Bach Knudsen, Aarhus University, Denmark
17:30-18:00	Discussions