

POLICY BRIEF

Precision Animal Breeding is the solution for future of livestock production and the world!

With a predicted 9 billion world population by 2050, we need to utilize all evidence-based technologies to maintain or even increase production. However, this must be undertaken in a way that protects the environment, ensures animal well-being and the viability of rural communities. Genetics applied to improve efficiency in livestock farming has a key role to play here.

1. Background Summary



With fixed or declining global resources, farmers must continually improve the process of food production and the sustainable use of our environmental resources. This involves fostering animal resilience to enhance their ability to cope with environmental changes and sudden climatic events that include new disease challenges, difficult grazing conditions, and other external stressors. The livestock industry needs to better use all its resources, including animal (genetic) resources, enabling it to reduce both its environmental hoofprint so that it enhances rather than damages the environment.

However, much of the livestock industry does not yet benefit from the state-of-the-art genetic and breeding technologies. At the population level, breeding objectives often do not incorporate features related to animal and system efficiency and resilience for long term sustainability. At the herd level, farmers struggle with interpreting the vast quantities of data available into tools supporting their decision of which animals to breed from and which animals to cull. They lack decision support tools to combine different components of resilience (like fertility, lameness, general health) or efficiency (like annual milk or meat production) into a composite value of animal worth.

2. Problem

Farming cattle is becoming increasingly difficult given environmental challenges and an ever-increasing demand for food security. The wider impact of animal diseases, increased competition for resources, coupled with the need to improve economic efficiency, whilst enhancing animal welfare and mitigating against climate change, are growing challenges for livestock farmers. However, if they could identify the most efficient and resilient cows, and breed such cows, they would potentially be able to keep less livestock, thus reducing the global environmental footprint without compromising economic or food security.



3. Reason behind the problem



At the population level, a major lever is the selection of parents of the next generation for the most pertinent breeding objective. This is a natural, inexpensive and cumulative strategy to improve production system efficiency, provided that the breeding objective is defined in such a way that genetic trend leads to the best adapted livestock for future (expected) conditions. The breeding objective is a combination of many traits of interest, some of which can be antagonistically correlated, and the right balance must be found to maximize resilience, the major component in the future, without compromising productive or economic efficiency.

A whole range of cow characteristics influence her future productive potential and these characteristics are not always readily identifiable or quantifiable, especially in large herds. It can be difficult to identify which cows are going to be the most efficient and resilient animals to keep and breed from, and which should be culled. This is further complicated by the need to find the optimal combination of resilience and efficiency. Thus, farmers need help to identify which animals to keep to best 'fit' their farm, its production system and economics and the prevailing climate.



4. Project Solutions:



It is clear that breeding from only the best animals will have a huge favourable impact on profitability and long-term sustainability. The EU funded project GenTORE will propose genomic solutions to cumulatively improve animal resilience without compromising efficiency and in doing so, select the most adapted genotype (including crossbred animals) for a given environment.

If farmers have an easy to use decision support tool incorporating a wide range of data on genetic and current performance credentials relating to resilience and efficiency, they will be able to rank their cows on expected lifetime productivity. This would enable farmers to quickly and accurately cull the worst animals and breed from the genetically elite animals. Selecting better animals offers an opportunity to keep fewer but more efficient and resilient animals.

Helping farmers to maximize the potential of their livestock system in this way would encourage the collection and sharing of data to enable comparisons both nationally or with similar farming systems thus improving national output whilst minimizing environmental hoofprint.

GenTORE is developing decision support tools based on genetic data and on-farm monitoring technologies that will enable farmers to identify their most efficient and resilient cattle in a full range of systems (beef, dairy and dual-purpose; conventional and organic). With the on-farm precision breeding management tool, selecting and breeding from these animals will enable farmers to make the most efficient use of their resources, keep fewer animals and diversify production, while improving economic efficiency and dealing with the climatic challenges they face.

5. Policy recommendations:



Policy recommendations targeting **farmers**;

- Farmers and producers need to be encouraged to use the genotypes that are most adapted to their future production systems, for the best economic and environmental return given the different on-farm constraints.
- Farmers need to be encouraged to use practical tools that aid in culling and breeding choices and avoid producing and rearing animals that are surplus to requirement and thus incur environmental and economic costs.
- Farmers need to be informed and encouraged to collect data that can be used to rank their cattle on the farm, applicable to their production system, thus improving efficiency and resilience.

Policy recommendations targeting **breeding industry**;

- The breeding industry largely determines the attributes of animals produced in future generations. It should be incentivised to offer a diverse pool of elite genetics with the best resilience without compromising efficiency, adapted to each production system.
- Making sexed semen available at competitive rates for all dairy systems to reduce the number of cows bred as replacement heifers, thus freeing up other cows to be mated to produce cross-bred animals for meat. Diversifying into meat production on dairy farms or at least maximising surplus calf value would also increase the economic resilience of the farm.
- Local organizations that already serve farmers like veterinarians, breeding companies and advisors can be supported by national or regional funds to provide training and advisory services to farmers on the use of on-farm precision breeding and management tools.





Institutional recommendations:

- Governmental organisations could provide cheap or free genotyping and phenotyping, especially for traits related to resilience and efficiency, in order to enhance the accuracy of genomic predictions for these two traits, as well as create a synergy with precision farming. Extensive systems, in particular, may not have the economic resources to justify the use of expensive precision technologies necessary to identify more efficient or resilient animals, so may need further economic support in this area.
- Governmental bodies should define economic policies that favour sustainable selection for resilience and efficiency, especially when they align with environmental policy objectives. Economic policies should also be defined to favour the use of precision monitoring technologies as these can greatly improve informed decision making by farmers, as well as making contributions to the attractiveness of modern farming. Whilst innovative farmers will adopt new ideas and collect accurate data, others will need to be encouraged by perhaps linking EU subsidies/commercial payments to the use of such tools based on best practice.
- Key to this will be policies that ensure farmers to have ownership of on-farm data generated by precision monitoring technologies.

Expected societal impact of the policy recommendations:



The tools developed by GenTORE will be practical and applicable across multiple cattle breeds (beef, dairy and dual purpose) and systems (conventional and organic). They will help improve the economic, environmental and social sustainability of European cattle production systems. These tools will be tested on farms. As a result, GenTORE and its tools will:

- promote diversity-rich livestock breeding, through support to both intensive and extensive industries,
- help increase the resilience of livestock production, including organic production, to more variable environments, while securing productivity,
- contribute to the innovation capacity of the European livestock production sector at a local breed level by enhancing the resilience and efficiency of these animals and their systems,
- contribute to reducing the environmental impact of the EU cattle sector, such as methane or eutrophication via greater efficiency, which leads to a reduction in the number of animals required to achieve similar production.

Project coordinator: Nicolas Friggens (INRAE AgroParis Tech)

21 Partners: 5 industry, 10 research, 4 extension organisation, 2 organic farming, 1 management

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For further information, see:



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