NUFFIELD FRANCE

Developing people through agriculture
Developing agriculture through people

Production of quality beef with respect for the environment and animal welfare

Financed by Nuffield France and partners

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Nuffield France Scholar 2019

"A pessimist sees the difficulty in every opportunity, an optimist sees the opportunity in every difficulty"

Winston Churchill

Thanks

I would like to thank the Nuffield jury for believing in me, in my ability to produce this report and in my capacity as representative of Nuffield France during these two years.
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I thank my parents, Monique and Jean Louis, for managing my operation during all my absences during my travels.

I thank the entire team of Nuffield France for their support and sympathy.

I thank my wife, Séverine, for her support, her presence and her confidence in this adventure.

I thank the Nuffield 2019 laureates from all the countries present at the CSC in Ames for their sympathy during this week of conferences.

I also thank all the ranchers and ranchers I met on my travels for the time they gave me and for their knowledge that they shared with me.

Finally, thank you, readers. By reading my report, you once again prove the public utility of the Nuffield Scholarship, a vector of innovative ideas.

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Introduction

Born in Béarn near PAU in the Atlantic Pyrenees, I grew up in Espéchède on my parents' family farm, at the time in dairy production. I trained as an agricultural school with a BEPA polyculture breeding in Montardon and then a BAC Pro, also in polyculture breeding at the agricultural high school in Orthez. Not being a big fan of school benches and with the aim of settling on the family farm, I continued my career with a pre-installation internship on a dairy farm in Compton, Quebec, Canada. Following this internship abroad, I first discovered the journey and the openness to the world it provides.

The return to the country was followed by the installation on the family business in 2006 with the resumption of the dairy business until 2012. This past year, an umpteenth dairy crisis and the near retirement of my associate parents are the reasons why I decided to stop this activity for beef production. The transition to Organic Agriculture will take place in 2018 for certification in 2020.

It was by chance by an article in the agricultural press that I discovered the call for applications for the Nuffield 2019 scholarship and it seemed obvious to me to apply which was selected in November 2019

Why did you choose this topic?

For many years livestock has suffered from many criticisms in the media

It is accused of polluting water by nitrate and green algae-generating droppings but also by the air by methane aggravate of the greenhouse effect; it is also accused of being the cause of deforestation by importing livestock feed from South America, often GMO.

Meat consumption is often singled out for the intake of bad fats causing cardiovascular disease and obesity.

The breeder is accused of suffering his animals because he would consider them only as mere objects. Associations like L214 are trying to discredit livestock with cleverly assembled videos in order to make it disappear.

New consumption patterns have emerged such as veganism. Vegans eat meat substitutes such as vegetable steaks that have reached supermarket shelves. In the near future, we may see "in vitro" meats on the menu of restaurants.

Unfortunately, all these accusations end up harming livestock. Yet animal production has been supplying protein for millennia with the goal of feeding humans.

Perhaps it would be good to remember that man was created by nature and not the other way around. It should also be noted that nature has made us omnivorous, which means that we must eat everything and therefore of course meat to satisfy our needs and not our desires.

Humanity began to support itself through hunting and gathering to provide protein and energy. Then man invented agriculture in order to secure his food supply and meet this fundamental and vital need to feed himself.

So, I chose this topic to see what was going on with cattle farming in the world and also to see if in other countries there was also this "Agri bashing" as can be seen in France.

As the title of my subject indicates, I wanted to know how best to reconcile the production of quality beef, respect for the environment and respect for animal welfare.

I have travelled several countries on four continents to meet breeders to see, understand and exchange on their ways of perceiving their profession. I wanted to know what kinds of problems they were having and what strategies they adopted in the face of these movements.

Despite a relatively small area compared to some countries, France has different climates (from the oceanic climate to the continental via the Mediterranean or the mountaineer) as well as different types of soils.
So, I travelled to several countries with different and varied climates to see how breeders have managed to adapt to these environments, sometimes very hostile or very advantageous.

Many questions then arose during my travels:

- What animal characteristics are sought to meet consumer demand?
- Is the choice of production based on a dominant breed or more on crossbreeding?
- What method of breeding predominates and what is the place of organic in their mode of production?
- Do they promote local trade or export?
- What kind of food did they eat? Does a diet based on cereals or grass appear to be essential to them?
- What economic impact does it have for the breeder so that he can live with dignity in his activity?

"Let your food be your only medicine!"

Hippocrates

I. Producing quality beef

Estimating the quality of a product according to ISO 8402: "It is defining all the characteristics of that product that give it the ability to meet expressed and implied needs for consumption. Quality is the ability of the product or service to meet the needs of users." As far as meat is concerned, quality includes several criteria: nutritional qualities, sanitary qualities and organoleptic qualities.

A. Cattle around the world

Humanity would have domesticated the first herd of Auroch 10,500 years ago and to this day, there are, because difficult to verify, about 480 cattle breeds in the world for a total of 1.7 billion cattle.

Globally, 80% of the beef consumed comes from the dairy herd but exporting countries do so mainly from nursing herds: Australia, the United States, Canada and more recently Brazil.

Livestock have allowed the conquest of large grasslands in these countries. Europe, on the other hand, has developed its nursing herd by valuing non-plough able grasslands. All these countries have selected specific breeds and developed systems that perform well from a productive point of view.

Here are some figures **on the distribution** of **cattle in the** world in 2017 (in millions of head):

- European Union: 88
- Asia: 422
- North America: 94
- South America: 270

France is the largest producer and consumer of beef in Europe, and the second largest European producer of milk after Germany.

The French market in a few figures:

- More than 2.5 million seed doses of 70,000 breeding cattle and several thousand French embryos are marketed each year worldwide.
- With 912,000 cows checked and 12,000 bulls assessed in operation, the French herd is the largest European reservoir of genetics for raising beef cattle
- 1.4 million tones carcass equivalent. This is French beef production in 2017

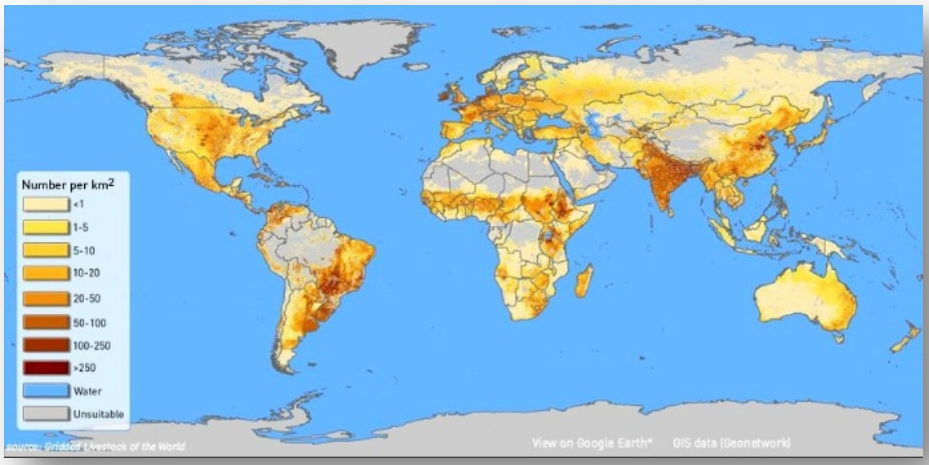


Illustration: On this map of the global distribution of cattle are the main breeding basins, to be linked to the climate of each major region. India is by far the largest country by cattle population (330 million cattle and buffaloes), followed by Brazil (219 million), China 137 (million) and the United States (89 million). (©Fao /Glw)

B. Beef production and consumption in the world

World Beef Production: Ranking Of Countries			
World		61,583,000	
Rank	Country	2017	% Of World
1	United States	12,086,000	19.63%
2	Brazil	9,500,000	15.43%
3	European Union	7,875,000	12.79%
4	China	7,070,000	11.48%
5	India	4,250,000	6.90%
6	Argentina	2,760,000	4.48%
7	Australia	2,065,000	3.35%
8	Mexico	1,910,000	3.10%
9	Pakistan	1,780,000	2.89%
10	Turkey	1,700,000	2.76%
11	Russia	1,310,000	2.13%
12	Canada	1,160,000	1.88%
13	South Africa	885,000	1.44%
14	Colombia	825,000	1.34%
15	New Zealand	610,000	0.99%
16	Paraguay	610,000	0.99%
17	Uruguay	605,000	0.98%
18	Japan	460,000	0.75%
19	Kazakhstan	435,000	0.71%
20	Ukraine	390,000	0.63%
21	Egypt	360,000	0.58%
22	South Korea	285,000	0.46%
23	Belarus	277,000	0.45%
24	Chile	220,000	0.36%
25	Vietnam	219,000	0.36%
26	Peru	210,000	0.34%
27	Philippines	210,000	0.34%
28	Iran	200,000	0.32%

○ Global beef production

Globally, the United States is the world's largest producer of beef, followed by Brazil and the European Union.

The United States, Brazil and the European Union Produce about 47% of the world's beef:

- The United States alone produces nearly 20% of the world's beef production.
- Brazil produces15% of the world's beef.
- The European Union produces almost 13% of the world's beef production.

Table: Production by country and tons carcass equivalent, of the world's *leading* beef *producers in 2017 (USDA source)*

World Beef Consumption: Ranking Of Countries			
World		60,910,000	
Rank	Country	2018	% Of World
1	United States	12,592,000	20.67%
2	China	8,530,000	14.00%
3	Brazil	7,935,000	13.03%
4	European Union	7,825,000	12.85%
5	Argentina	2,565,000	4.21%
6	India	2,400,000	3.94%
7	Mexico	1,860,000	3.05%
8	Pakistan	1,736,000	2.85%
9	Russia	1,685,000	2.77%
10	Turkey	1,500,000	2.46%
11	Japan	1,314,000	2.16%
12	South Africa	1,005,000	1.65%
13	Canada	935,000	1.54%
14	Korea, South	830,000	1.36%
15	Colombia	739,000	1.21%
16	Egypt	685,000	1.12%
17	Australia	683,000	1.12%
18	Hong Kong	586,000	0.96%
19	Chile	495,000	0.81%
20	Kazakhstan	481,000	0.79%
21	Iran	420,000	0.69%
22	Philippines	395,000	0.65%
23	Ukraine	297,000	0.49%
24	Vietnam	286,000	0.47%
25	Malaysia	237,000	0.39%
26	Paraguay	234,000	0.38%
27	Peru	218,000	0.36%
28	Algeria	210,000	0.34%
29	Israel	195,000	0.32%
30	Saudi Arabia	195,000	0.32%
31	Taiwan	182,000	0.30%

○ Global beef consumption

The United States is the world's largest beef consumer in 2018, followed by China and Brazil.

The world consumed 60.9 million metric tons of beef in 2018. The United States accounted for about 21% of the world's beef consumed in 2018. Twelve countries consumed more than one million tons of beef in 2018.

Table: Total beef consumption per country in tons carcass equivalent in *2018 (USDA source)*

C. What is quality meat

1. Quality via nutritional composition

To define quality meat, this requires nutritional composition.

In order to study the nutritional composition of meats, a program of analyses was conducted by INRA (National Institute for Agricultural Research), in collaboration with ANSES (National Agency for Health Safety, formerly AFSSA) on 30 pieces of beef, veal, lamb and horsemeat.

Focus on key results:

- A constant protein richness, with 17 to 23 g/100 g depending on the pieces and proteins of high biological value (balance in essential amino acids close to human needs and high digestive absorption).
- 2/3 of the pieces with less than 8% fat (lipid): The fat content depends mainly on the lump: some are very lean with less than 3% fat (e.g., slice tend, veal, etc.) and the vast majority bring between 3% and 8% fat. For the fattest (steak, lamb or veal ribs, etc.), simply remove this "fat" visible on its plate, to divide their fat levels by two or three.
- Fats with a varied composition with:

- ✓ As many monounsaturated fatty acids (AGMI) as saturated fatty acids (AGS) and a few polyunsaturated fatty acids (AGPI).
- ✓ Very moderate levels of trans fatty acids (TTA) (0.2 g/100 g on average for beef, for example); trans fatty acids mainly of natural origin for which, in the opinion of AFSSA, no association is observed with coronary risk at the levels at which they can be consumed, in western populations".

- One of the best food sources of iron with a high proportion of heminic iron - the form of iron best absorbed by the body.
- Vitamin B12 richness and an interesting intake of other essential nutrients: zinc, selenium, vitamins B3 and B6

Proteins are composed of twenty amino acids, nine of which are essential because they cannot be synthesized by the body. They must therefore be brought by food.
Meat proteins have the advantage of being of very good quality since they contain all the essential amino acids in balanced proportions and are well assimilated by the body.

Vitamins are all essential to the functioning of the body. Each food category contributes differently to vitamin intake. Covering your needs therefore requires varying your diet. Meat mainly contributes to **vitamin intakes** in group B: B3, B6 and B12.

Vitamin B12 (cobalamin) is essential for the formation of red blood cells and therefore for the transport of oxygen. It also contributes to the proper functioning of the brain. This vitamin is **only present in animal products.** All meats and tripod products are rich in vitamin B12.

The result of this study clearly shows the natural need for meat in the human diet. Switching to a vegan-type meat-free diet will require a synthetic vitamin B12 requirement as it is only found in natural meat products.

However, overconsumption of meat, especially red meat, tends to increase the risk of certain diseases (such as colon cancer, cardiovascular disease, obesity or type 2 diabetes and more generally increases mortality. The links between red meat consumption and these chronic diseases were also supported by Anses.

THE WHO has officially classified red meat as a probable cause of cancer in humans and processed meats (charcuterie, nuggets, corned beef, "blue cord", etc.) among the certain causes of cancer in humans.

Meat is a natural product, which does not exclude that it must be consumed responsibly. Like many food products or not for that matter. Deficiency or excess always brings its share of disappointments.

"In medio stat Virtus" (Virtue is in moderation)

	INSTITUT DE L'ELEVAGE / INRA	le Bœuf d'herbe
Lieu d'expérimentation	Station expérimentale de Mauron (56) Les Etablières (85) Jalogny (71)	Elevage de la Coquerie (44) Pierre Hinard
Race	Blondes d'Aquitaine et Charolaises	Salers
Alimentation	Ensilage de maïs et concentré	Herbe et foin
Teneur en OMEGA 3 En % des Acides gras totaux	0,48 %	1,5 %
Rapport OMEGA 6 / OMEGA 3	11	1,6

Analyses réalisées pour le Boeuf d'Herbe par le laboratoire In Vivo Labs – Saint Nolff – 56011 Vannes

Sur un échantillon de steak haché de bœuf d'herbe Lot 0535 du 14/01/2015

However, cattle feed also plays a role in the nutritional qualities of meat. This is the result of INRA, the livestock institute and a group of breeders formed under the name "Grass Beef".

It shows that grass-fed beef has the distinction of being 3 times richer in Omega 3 than other meats derived from animals attended by cereals.

Intensive farming (corn and cereals) reduces the Omega 3 content of meats and increases the content of Omega 6, the fatty acid responsible for the ignition processes and multiplication of fat cells.
The ideal Omega 6/ Omega 3 ratio is between 1 and 5 and as close as possible to 1.

The result of this nutritional ratio for intensive breeding is 11: result too high.
For beef with grass, the result is 1.6, which is the recommended standard.

This result is also shared by other countries. The United Kingdom, the United States, Canada and New Zealand have also done studies and report the same result. This has been followed by numerous labels (e.g. "Only Grass Feed») that advocate to the consumer the nutritional benefits of meat produced entirely on grass.

Here are some examples of the countries mentioned above:

Canadian label, Label of the United States and Label of the United Kingdom

Because of the nutritional quality that comes out of the meat of grass-raised animals, I have made the choice to visit mainly, farms that are aware of this advantage. My goal is to find out how they get the benefit.

Whether in the UK, South Africa, USA, New Zealand, Canada or close to the arctic circle, cattle are well aware that cattle are an herbivore and a ruminant. The grass is very economical because a meadow lasts long after implantation. When the prairie is of a temporary type, some species are in place for 5 years or more like the dactyl or the high fescue.
Permanent grasslands, on the other hand, have never returned and do not fit into any crop rotation pattern. Breeders practice over-seeding, or some let the plants in place grow in seeds. In this way, they naturally reseed without any purchase by breeders who would like to rediscover the spirit of the "great American prairie" ecosystem in its own right that housed millions of bison.

On the farms I have been able to visit, the "Only Grass Feed" is a marketing-level weighty argument for marketing and the taste of meat.

2. Quality via race

In terms of the taste quality of a meat, the racial type has its impact depending on the population and culture. Each country has its racial type more or less privilege.

For most of the farms visited, angus or Aberdeen Angus often comes out in the first choices for its "marbling" in English. This is intra-muscle fat. Not to be confused with the coverage fat. This fat seeps into the meat, which gives it great tenderness. This breed has the peculiarity of having this characteristic in its genetic heritage and it is often used in crossbreeding to bring this gene. It comes first in many Anglo-Saxon countries.

In South Africa and other hot and humid countries, it has a good reputation, but this type of climate does not allow this breed of this developed without having to make investments to adapt it and thus result in a loss of profitability.

Kobe or Wagyu beef is considered the best meat in the world. It is compared to caviar and easily exceeds $150/kg. What makes it a luxury breed that few people can afford, I for one have never had the honor of tasting it. It also has the distinction of being extremely parsley. As a result, it is very tender and when cooked, cutting it with a knife is comparable to cutting butter. It is a very fatty meat due to its energy-rich diet and low protein. However, it is to everyone's taste because some people do not appreciate as much fat in their meats.

Illustration: Kobe's fake beef fillet, where the on notices *the impressive amount of intramuscular fat in this photo.*

While on the other hand, in Belgium, the local breed Blue Blanc Belgium is very appreciated because extremely skinny.

The Galician Blonde from Spain is also very well known. It was ranked number one on a test organized by the New York Times x USA for its taste and marbling.

Our country France has many breeds such as the Limousine, the Aubrac, the Bazadaise... and to each breed an amateur to raise and taste it! The same is true all over the world because there are about 500 cattle breeds around the world.

3. Quality via visual and flavor

It is at this level that there is a big difference between English-speaking culture and continental Europe. When in France, animals are classified at the slaughterhouse on a EUROPA grid that favors breeds with high muscle development, English-speaking countries, they rank on marbling (or marbling).

In the United States, they focus on marbling or intra-muscle fat and give a rating on the following quality criteria: **Select, Choice and Prime** (from lower quality to higher quality in that order). That doesn't mean that a Choice steak, or even a Select steak, won't eat better thana better steak. However, given a sufficiently large sample of testing, it was determined that the higher the quality, the better the culinary experience.

The most sought-after marbling is called **"fine."** Fine marbling is small fine particles of fat in the lean muscle, and when you have a high frequency of fine marbling, you have a high-quality lump. And that's why Kobe beef or Black Angus are so popular on the restaurant scene in these countries.

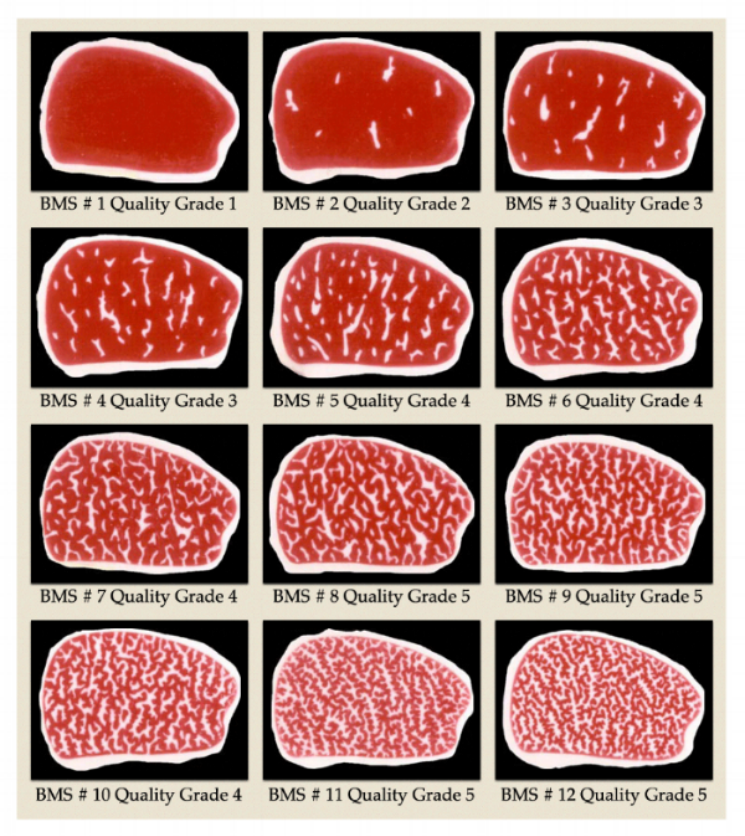


Illustration: USDA's official grid for the listing of the beef persead.

The European regulation that defines this prioritization of meats contains two main criteria, which are the level of fattening and conformation.

- *The level of fattening:* it informs about the amount of fat present in the animal. This level is composed of 5 tiers, ranging from a scale of 1 (very lean meat) to 5 (excessively fat). So, you'll have guessed that the ideal fattening is level 3. It is an intermediate level between excess fat in the beast and a clear deficiency.
- Conformation: Conformation is a criterion of the "shape" of the beast. As with the fattening level, it is established in 5 levels: the letters E.U.R.O.P. The letters are ranked in a decreasing order: the more muscle capital the beast has (back and back), the more valued it will be, and it will be classified as E (or U).

However, it is important to distinguish the shape (or conformation) of the animal from its taste quality, even if one may contribute relatively to the other.

North American reasoning seems more logical since it is the flavor, taste and culinary experience that is important. On the contrary, in the European system, it is ultimately more the cost-effectiveness of the cutting chain that dominates. The industry prefers a 700kg carcass with blanket fat over two 350kg with intra-muscle fat. That's less animals on the shade chain.
However, the consumer is totally unaware of whether the steak on his plate comes from a lively 1200kg animal or a 700kg animal. What he wants is to have fun tasting what he bought.

And it often emerges, regardless of the field, that quantity is at the expense of quality.

It would seem that this creates an injustice to medium breeds or small size since an Aubrac, in medium format will never be valued at the price of a big blonde of Aquitaine in the conventional circuit. Although, however, the taste quality for the consumer is not guaranteed on the large carcass.
A good way to verify this is to analyze the development of short circuits and direct sales to the consumer.

Customers' loyalty to their breeder is based on the taste quality of the meat. Medium-sized breeds are very successful in this type of market and breeders are more profitable with more hardy animals than they would have done with large breeds.

In many countries, breeders seek and get this marbling, but to get there every aspect of their program is important; the mode of breeding, the manipulation, the feeding, the age of the animal (neither too young nor too old) and this until the weather.

Many ranchers choose to follow a branded breeding program, such as certified Angus beef in the US, because different Labels have taken years to improve their programs to ensure consistency of quality. Branded programs can provide breeders and restaurants/retailers with higher revenues, as customers also trust this consistency.

Illustration: Angus Meat Certified Label in the United States.

The livestock institute was interested in the point of view of the French consumer and his perception of the product. At a conference in Paris in November 2017, Jérôme Normand de l'Idele presented the results of a study: "Perception of the parsed and vacuum packaging of meats by consumers."

By performing an organoleptic analysis with a panel of consumers, it turns out that they react first to the visual. For example, raw, heavily marbled meat is poorly perceived by consumers, while such a level is appreciated in the mouth. Conversely, the results of the study show that a low level of marbled is rather well perceived on raw presented meat, while in the mouth, the quality is less appreciated.

To conclude:

We can understand that the concept of meat quality is a complex concept to define. Depending on where you stand:

For the farmer, the diet and the choice of genetics (race) will be preferred ....

A butcher will favor the mode of breeding, the grain of meat and its finesse, the presence of fat and marbling, regularity and homogeneity.

For the consumer, for example, the quality of a meat will be reflected in its color, tenderness, juiciness and flavor. ...

As a Latin proverb sums it *up, I quote:*

"D e gustibus et coloribus non disputandum» (Tastes and colors are not discussed)

II. Produce with respect for the environment

The major challenge to date for beef production is to maintain or even expand its production in quality and quantity while respecting the environment in view of the increase in the world's population and the space available for agriculture.

A. Sustainable agriculture

After the various modern agricultural revolutions, sustainable agriculture presents itself as the agriculture of the future. What are the principles and challenges of this sustainable agriculture?

1. Origin and principle of sustainable agriculture

Intensive agriculture, as it has been practiced since the 1960s, has extraordinary yields, but it depletes soils and pollutes the environment. Maintaining the same yield always requires increasing the number of inputs (water, equipment, pesticides and fertilizers).

The recent awareness of the limits of natural resources and pollution of soil, air and water is pushing towards a new agriculture, sustainable agriculture.

Sustainable agriculture is based on the principles of sustainable development, as first defined in 1987 by the report of the Unass Environment and Development Commission, says Brundt land report.

Sustainable development aims at current economic development, without compromising the resources and environmental quality of future generations. Sustainable agriculture is based on the three pillars of sustainable development: ecological, social and economic.

Sustainable agriculture must feed the population and develop the economy while limiting its impact on the environment in order to be sustainable. To do this, it must be based as much as possible on a circular system, allowing the maintenance and regeneration of resources, or even their improvement.

Sustainable agriculture is in fact a modern return to the very principles of ancestral agriculture, which preserved its resources, recycled its waste and protected its seeds and species.
Sustainable agriculture must try to apply these principles as much as possible:

- Optimal use of natural resources, primarily water.
- Recycling plant and animal waste to fertilize and maintain soil quality (compost and manure).

- Use of green waste as biomass (fuel, fuel, biogas) to create energy.
- Limiting greenhouse gas emissions, including by promoting short consumption channels.
- Limiting environmental pollution by reducing the use of fertilizers and pesticides.
- Maintaining and using natural predators and pollinators.
- Product traceability to ensure food safety.
- Maintaining the biodiversity, natural ecosystem and genetic heritage of endemic cultivated species.
- Development of agricultural landscapes and the fight against desertification.
- Respect for animal welfare.
- Respect for working conditions and the health of workers and residents.
- Local economic development.

2. The challenges and limits of sustainable agriculture

Sustainable agriculture is developed by societies that have become aware of the limitations of intensive agriculture. Some countries, such as the Southern States, are thinking of feeding their people as a priority.

Also, Europeans and Americans are at odds over what to do about global agricultural policy, particularly for developing countries. For Europe, sustainable agriculture is the prerequisite for securing the food resources of future generations and preserving the environment. Thinking global, consuming local is the basis of this theory. Americans, for their part, less concerned for the most part about environmental pollution, rely on the development of mechanization and wworld's growing population.

Sustainable agriculture will have to prove itself in the face of intensive agriculture. If it is more reasonable, notably by refusing over-exploitation of soils and pollution, it cannot have the same short-term yields as its ultra-performing rival.

B. The impact of the livestock model on the environment

1. The intensive breeding mode

Intensive farming, as the name suggests, is done in such a way as to produce maximum in a minimum of time and investment so that it is very productive and very profitable. It is carried out in part or in full in buildings mainly in Europe or in feedlot in North America, South America and Australia.

In order to be environmentally friendly, this type of breeding requires the breeder to recover and manage the droppings. These will be used in a fertilizing manner and the quantity will have to be resonated according to the nutrient content of the crop in place or the next in order to preserve the water table and rivers following possible runoff.

However, these restrictions are set differently depending on the country and their environmental policy.

On feedlot breeding. During my visit to Colorado, I was able to visit these famous installations that are so much talked about in France. And indeed, environmental standards are present but very non-binding.

For meat-type animals, the breeding phase is carried out in the great plains. This is the fattening phase that takes place in the feedlots. Some dairy farmers entrust the owner of feedlots, the breeding phase after weaning.

It is clear that at first glance, the environmental aspect is completely damaged. Because of the very strong smell as the facilities approach and the little litter brought to the animals. We can also ask the question of respect for animal welfare in this way of breeding....

The animals are parked by paddock on an unmeted floor. Infiltrations in the basement are not retained. In Colorado, frosty temperatures during the winter prevent mud from forming because faces freeze quickly. But in other seasons, nothing blocks these infiltrations and runoff that will certainly end up in the water table or f-bone and rivers. The rains of course amplify this phenomenon.

The parks span large areas with an impressive number of animals. Colorado's largest is home to 120,000 animals.
The parks are cured, and the manure is stored in the crop plots. However, there are no restrictions on quantities and application periods. When I was in Iowa, the farmer was spreading manure on the snow. This practice is not recommended for nitrate retention and is totally prohibited in France.

Illustration: Feedlot of 25 000 places au Colorado

Finally, you don't have to be a strong advocate of nature to realize that these breeding conditions are very disrespectful to the environment. In the land of "business" it is a priority for the dollar and environmental standards are a brake on profitability.

2. The extensive farming mode

Extensive breeding, or extensive grazing, is a method of rearing characterized by a low density per hectare of animals. This type of farming is essentially based on the use of available natural resources: water, pasture, etc. using little or no inputs. The production system is based on grazing. Extensive breeding is usually carried out over large areas, which animal access as they move. In a way, it's about producing a little less, but better.

The notions of "extensivity" or "intensity" remain relative. The legal texts define intensive agriculture as "an agriculture that consumes more factors of production per unit of surface area" and it can therefore be inferred that the extensive consumes less.

No specific criteria define this "plus" and "less": they are therefore models, not specifications or certification, as is the case with organic. Also, beef production from extensive farming is not necessarily organic, but on the other hand the organic is still derived from extensive breeding!

Cows feed mainly on pasture grass. The forages (cereals, vegetables, etc.), necessary in winter, are usually grown on the farm. Manure and manure are assimilated by plants and are a natural fertilizer for crops. Thus, livestock and agriculture complement each other.

Finally, extensive farming tends to exploit an environment without damaging it: it is a sustainable mode of agriculture, which allows the maintenance of the characteristics of the environment, or even improves them from an environmental point of view. Extensive grasslands and pastures, beyond their interest in biodiversity, also provide many joint services, in terms of landscape, water quality, and soils.

3. Biodiversity in the farming mode

Biodiversity, by definition, is the diversity of living species (microorganisms, plants, animals) present in an environment.

If we compare these two modes of breeding, intensive and extensive, the first will be mainly based on monocultures type cereals, while the second will be based on grass and pasture. Monoculture means the need for mechanization, inputs and labor. The mono grain crop is something artificially set up. The goal is to harvest a single plant which requires the destruction of other species that will grow there. To achieve this, it is necessary to work the soil so need equipment and fuel as well as pesticides to destroy any competition with the chosen species. This requires the use of fossil fuels and synthetic molecules to destroy insect pests and competing plants. This has led chemists to invent GMOs forever to be more efficient on the control of these pests or weeds.

For extensive breeding, the chosen crop is the prairie. This type of culture exists in nature and has its own biotope in the same way as a forest. They are found in all kinds on every continent. As cattle are a ruminant, they can turn into meat or milk, many plants which means that a plant considered to be a weed in a monoculture, will not be in a meadow. The non-work of the soil preserving the wildlife in the basement. The choice of a multi-species prairie is beneficial for the interaction that different plants have with each other, such as legumes and grasses. The prairies are also home to a great deal of wildlife.

We are seeing more and more initiatives in the world for the development of sustainable livestock. In the United States, anew studied by Megan O'Rourke, associate professor at Virginia Tech's School of Plant and Environmental Sciences, examines how to increase bee-friendly plants while meeting the needs of cattle along the "fescue belt" that stretches from the Carolinas to Kansas, more than 1,000 km away.

The team will test 20 different wildflowers from the state of Virginia and Tennessee and measure the ones that attract the most bees and, when planted alongside native grasses, produce the healthiest livestock. If successful, adding native wildflowers to pastures in the fescue belt will become a new conservation practice. For example, the USDA National Resource Conservation Service will share the costs of setting up with ranchers.

Illustration: Study examining how to increase bee-friendly plants while meeting the needs of cattle along the "fescue belt" in the United States.

Barbed wire or electric wire fences are also a problem for wildlife. They impede the movement of wildness and can cause injury. New technologies can be a solution because, as with dogs with virtual fencing, companies are working to adapt this technology to livestock.

An Australian company, Agersens markets its eShepherd system. A virtual fence that can be moved with a simple smartphone. A Norwegian company also has a similar system for goats. She is currently working to adapt it to cattle. France, with Lacmé is not left out and offers a system also called Boviguard.

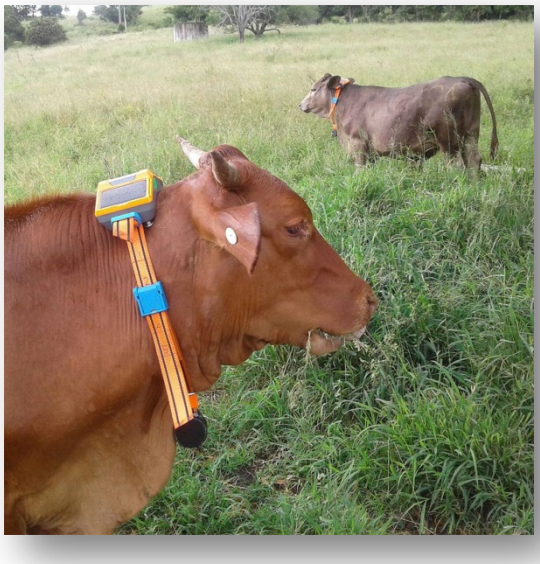


Illustration: The eShepherd solar-powered fence necklace.

C. Towards a reduction in environmental impacts?

1. The impact of methane release and carbon storage on the environment

Ruminants (cattle, sheep, goats) have the specificity of being able to digest grass - which man, for example, cannot do. They thus value non-ploughable land (for example, steep, wet or stony).

Indeed, these animals possessing their rumen (one of their 4 stomachs) bacteria that degrade cellulose: a very solid fiber of plants. This natural fermentation produces methane that is emitted by eructation. Methane is a gas that contributes to the greenhouse effect. It corresponds to 5% of the greenhouse gases emitted in France. As far as knowledge is concerned, there is little room for workforce on the emission of methane from rumination, but research is being developed on animal feed or rumen bacterial flora.

Fortunately, in return, grass, consumed by ruminants (60-80% of their diet), captures CO2 from the air and converts it into carbohydrates (vegetable tissues) through photosynthesis. When plants wither, this carbon is integrated and stored sustainably in the prairie soil. In the end, most of the methane that cows release is offset by carbon storage in the soil of the grasslands they graze on.

Ruminant farming therefore preserves 11 million hectares of permanent grassland at the national level, which, if ploughed, would release a large amount of carbon into the atmosphere (1000 kg of carbon per hectare per year).

Illustration: Cycle of methane (CH4) produced by ruminants and absorbed by plants via photosynthesis.

According to the Food and Agriculture Organization of the United Nations (FAO), 14.5% of greenhouse gas emissions come from beef cattle farms.

The University of Liège Gembloux Agro-Bio Tech has been working since 2010 on CO2 exchanges between permanent grasslands and beef cattle farming. The aim is to objectify the relationship of a grass-related breastfeeding model with greenhouse gases (GHGs), which are partly responsible for global warming.

The university has carried out finer studies on efficient meat systems in Wallonia, obtaining results diametrically opposed to those of FAO, which took the worst of references as the basis: American feedlots. On the one hand, we are talking about 250 to 300 cattle/ha without grass, on the other, 2.3 animals/ha in pasture.

The research team looked at the inflows and exits of carbon monoxide (CO) and methane exchanged by the pasture to achieve a carbon footprint. If there is any remnant, it must be in the ground. Since2010, a weather station and sensors have been installed in a permanent meadow for Adrien Paquet, a Belgian blue white breeder in Dorine, so that the study is the most representative of what is practiced in Wallonia. The average livestock load was 2.3 UGB/ha. Dry matter yield is around 8 t/ha. »
The assessment involves taking into account photosynthesis, soil respiration, vegetation and cows. The net exchange of the ecosystem was measured, taking into account, among other things, the supplementation of the ration when the cows are grazing, and the organic fertilization of the meadow. By calculating the difference between import and export of CO2, we discover whether the balance is in emission or absorption and how the soil reacts.

In terms of net flow, for each year studied over the past nine years, plant photosynthesis is more important than the combined respiration of livestock and the ecosystem. Nature absorbs more carbon than it emits, even when years have had a longer winter or late vegetation. According to the scientists, between 0.5 and 1.5 tons of carbon was stored per hectare per year. To give an order of magnitude, it is like writing that a hectare of grassland would absorb the carbon emitted by a car that would travel between 15,000 and 45,000 km per year. Eating meat maintains our grasslands that store CO2 in the soil. It's a virtuous cycle.

At the CSC in Ames, Iowa, we met Dr. Franck Mitloehner, a professor and air quality specialist at Davis University in California.

Mr. Mitloehner is particularly opposed to the United Nations declaration that livestock represent more greenhouse gases than transportation.

It notes that "Livestock's Long Shadow" produced its figures for the U.S. livestock sector by adding farm-to-table emissions, including gases produced by growing feed production, animal digestive emissions and processing meat and milk into food.

But their analysis of transport also did not add up the missions from one point to another. Instead, it only took into account emissions from fossil fuels burned while driving.

According to Mitloehner, the main authorities believe that cattle and hogs for food in the United States account for about 3% of all greenhouse gas emissions, while transportation generates about 26%. Because in their calculations of the total released by transport, it is taken into account only the fuel to operate these vehicles. But we must take into account the whole cycle, namely, the construction of vehicles (aircraft, truck, car, boat...) and the infrastructure necessary for their operation (construction and maintenance of airports, maintenance of roads, cars, trucks ...)

Methane and CO2 produced in agriculture goes into the natural cycle where it will be recovered by plants via photosynthesis while the CO2 produced by transport has come out of the underground to

inflate the stock in the atmosphere. For him, the paths are to increase yields in order to be able to further divide the gases per food produced. Rich countries should focus more on energy for transport or heating, for example, and developing countries, focusing their efforts on food production. Because 1 ha in developed countries is fed more population than in a developing country.

However, for him, the intensification of production requires "new technologies" such as GMOs, growth hormones, plant health products or mechanization. This can pose an ethical problem with the natural.

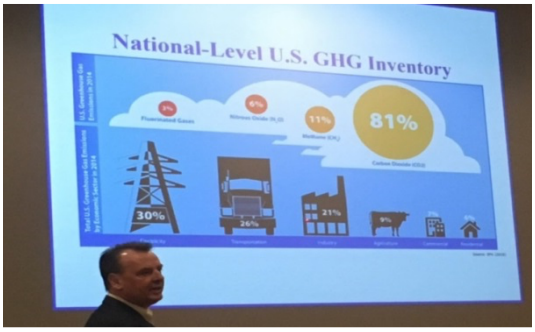


Photo: Dr. Frank Mitloehner during his speech at CSC 2019 in Ames Iowa.

2. Leverage to reduce methane emissions from ruminants

Research to reduce methane release from herbivores is not left behind. This is a major economic issue because the global meat industry supports a lot of people.

In all countries, researchers are working to find solutions. During my stay in New Zealand with Corrigan Sowman, Nuffield Scholar 2019 and dairy farmer, we discussed the work of Dr Suzanne Rowe. She is a scientist who breeds a strain of sheep emitting less methane than ordinary sheep.

Methane emissions from New Zealand's sheep and cattle account for one-third of the country's greenhouse gas emissions, the country's largest contributor.

Since 1990, methane from herbivores has increased by 10%, according to the Ministry of the Environment, with a 70% increase in dairy cattle and a 44% decrease in the number of sheep.

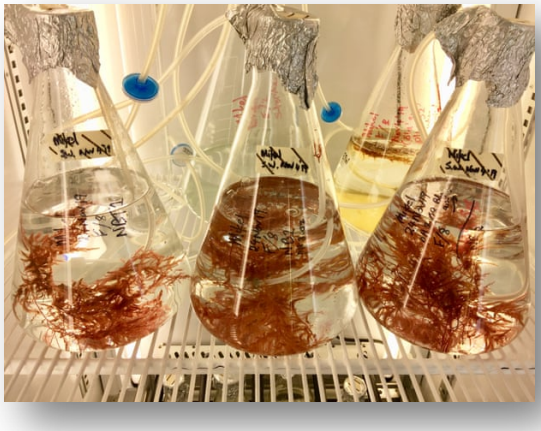
As a result, methane has been in the crosshairs of government climate action policy, and scientists across the country are being given the green light to run freely with their brightest ideas for reducing emissions.

Under zero-carbon legislation, methane targets are separated from other greenhouse gases, with the aim of reducing biogenic methane by 10% by 2030 and 24-47% by 2050.

In Nelson, north of the South Island, the Cawthron Institute recently received government funding to grow and research a native red alga known as***Asparagopsis armata.***

Agriculture Minister Damien O'Connor said that if this algae could be mass-produced, it could be a game-changer for farmers here and around the world, as it has been shown to reduce herbivore methane emissions by 80% when added as a dietary supplement to as low as 2% of the daily ration.

Mr. O'Connor said the potential of algae not only in New Zealand but around the world was "enormous."



Asparagopsis armata at the Cawthron Institute

Other products generally offer reductions of between 10% and 20%. Australian research estimates that if only 10% of the world's ruminant producers adopted Asparagopsis as an additive to feed their livestock, it would have the same impact on our climate as the removal of 50 million cars from the world's roads. Knowing that there would be 1.2 billion cars, which represents 5% fewer cars.

North of the town of Waikato in Hamilton, in the heart of dairy country, Dr. Bjorn Oback of AgResearch received NEW Zealand$10 million in government funding to design a "smart cow» in the face of climate.

There are more cows than people in New Zealand and although they have become a mainstay of the economy, they also draw environmentalists to the ire of their high methane emissions and their intensive impact on polluting soil and swamps.

Dr. Oback says specialized breeding programs can take decades to achieve the desired result, but using genetic modification, his team can design a climate-smart cow much faster and more accurately - although the process remains controversial.

In addition to working on the genes that control methane intakes, Oback is also focusing on the design of cattle that will thrive in a climate-altered future, more heat-tolerant, more robust and productive animals.

The program already aims to adapt the color of the dress, creating lighter-colored cows, making them more resistant to heat.

An important feature of the program was the use of "elite" cattle, Oback said, so it would not only emit less methane but would adapt more easily to the climate. It will also perform better.

During the study, they select a high-performing elite dairy cow and then make genetic mutations.

Oback's work is closely linked to Dr. Rowe's research on low-emission sheep in the south of the country. In order for Oback to study and try to manipulate the genes of low-emission cattle, he is invested in the breeding of Dr. Rowe's herds, which are now in their third generation.

The work of Dr. Rowe and his team is creating buzz in the farming community because not only do his sheep have low methane emissions, but they also produce more wool and are more resistant and healthier than normal sheep. At this stage, 20 major breeders have already signed up to produce herds with low-emission sheep and have the support of Beef and Lamb New Zealand, an industry organization.

Dr Rowe explains that they noticed a 10% drop in production of methane produced between their sheep and the conventional sheep.

Many methane reduction programs are under way in New Zealand, with climate-smarter cows in the next five years and the massive deployment of **Asparagopsis armata** within five to ten years.

However, this "smart cow" encounters the problem of legislation because under current legislation in many countries, the modification of the genome of life is still classified as GMO and therefore prohibited.

France is not left behind on research since INRA has been researching for more than 15 years. Their results show that flax can reduce methane production by 20% and lately garlic is being studied.

A dairy cow produces 90 kilograms of methane each year. That's 10 times more than for sheep, for example. And if garlic is able to bring down this mini-methane plant, it is by its antibacterial and inhibitory effects of a specific enzyme of methane-producing microbes.

With this in mind, a Swiss company, Mootral, plans to introduce a dietary supplement composed of garlic and orange peels in the near future, which is expected to reduce exhaled methane by 30%. However, the two recent studies conducted with this preparation do not converge. The one conducted by researchers at the University of California and the test on 20 animals does not show an effect until the end of the 12th week (-23.2% methane produced). Overall, over the duration of the study, the result is not significant, the publication concluded.

The other study, on the other hand, details a decrease of 38% on the jersey breed and 20% on Holstein. But according to Diego Morgavi, an herbivore specialist in the Dynamic team at the INRAE Clermont Auvergne Rhône Alpes center, the use of a laser to measure methane is not the most reliable method available.

For the researcher, the effects of these modified diets are still difficult to quantify. The dose effect plays, as well as the form in which garlic issued. Raw, dry powder, essential oils... Mootral's formulation is not specified. Other solutions seem to be promised for wider use. The Dutch company DSM has applied for authorization to market 3-NOP (nitrooxypropanol) on the European market and plans to market it from 2021. It also aims to reduce cattle methane emissions by 30% by effect on enteric fermentation. The product, developed with Pennsylvania State University and Otago University in New Zealand, has been evaluated in about 20 scientific publications, according to the company.

There is a sense that there is a huge challenge in reducing methane production. The industry is not standing idly by and this is a lot of research. Solutions are emerging on all sides because beef or milk production is present in many crops and remains a choice.

It remains to be seen how much more this will cost to the final product and the impact on the consumer's wallet knowing that beef is already the most expensive.

"Ecology is also and above all a cultural problem. Respect for the environment requires a large number of behavioral changes. »

Nicolas Hulot

To conclude:

We all know that tomorrow's goal is to produce while respecting natural ecosystems. Cultivation and breeding are known for their so-called strong impact on the environment.

But we must also remember that livestock farming plays a key role in soil fertilization and helps to maximize food production per unit area. It allows the recycling of co-products of cultures and enhances uneducated spaces.

Thus, consuming organic meats based on an extensive model would contribute to the reduction of CO2 emissions since the grasslands are able to store this CO2 in the soil.

However, after the various modern agricultural revolutions, sustainable agriculture presents itself as the agriculture of the future but is not yet a priority for all countries. Indeed, it is developed by societies that have become aware of the limits of intensive agriculture. Some countries, such as the Southern States, are thinking of feeding their populations and bringing in foreign exchange through exports.

Many studies and research have been carried out around the world to find solutions for better environmental respect. But for many of them, they sometimes face ethical or legislative problems. This is the very example of genetic modification to create a "smart cow."

Sustainable agriculture is a complex process that will have to prove itself in the face of intensive agriculture. If it is more reasonable, it cannot offer the same short-term returns as its high-performing rival.

III. Produce with respect for animal welfare

"At a time when environmental issues are becoming unavoidable, there is a growing recognition that animal welfare goes hand in hand with the sustainable development of livestock, and this will undoubtedly contribute to a shift towards new practices that are more animal-friendly," said Dr. Monique Eliot, Director-General of the OIE (World Organization for Animal Health) at the 4th OIE World Conference in December 2016.

A. What is animal welfare?

The well-being of an animal is defined as "the positive mental and physical state associated with meeting its physiological and behavioral needs, as well as its expectations. This condition varies depending on the animal's perception of the situation. This definition applies to all animals that live under the dependence of humans (breeding, company, leisure, laboratory).

Here, the definition of animal welfare applies specifically to livestock in order to understand its role in sustainable agriculture.

Animals are sentient beings, that is, they can experience physical and psychic sensations and feel emotions. As such, the Farm Animal Welfare Council published the "5 Freedoms" principle in 1979, which sets out the basic conditions of welfare to ensure the welfare of an animal:

- Lack of faim, thirst and malnutrition
- Absence of physical and thermal stress
- Nodule, injury and illness
- Absence of fear and debriding
- Opportunity for the animal to express normal pairings of its species

Beyond the sensitive nature of animals, the collective expertise conducted by the National Institute of Agricultural Research (Inra) reveals that animals are endowed with a consciousness, that is, they have a subjective experience of their environment and their relationship with that environment. In order to assess the welfare and quality of life of animals, it is therefore necessary to go beyond the well-treatment and take into account the feelings of the animals.

B. What practices are being implemented?

In Europe, animal welfare for cattle is highly regulated. For some years now, associations have been fighting to make consumers aware of the importance of the well-processed processing of farm

animals. Many Labels impose strict standards in their specifications. The most "binding" is that of Organic Agriculture. It imposes strict measures on food, living space, manipulation, medicine...

You should know that being a breeder is a great part of a vocation for the people who become it. It is then obvious that they respect their animals as best as possible, much like a mechanic takes care of his car.

All the breeders I met during my Nuffield trips were well aware that they had to give their best to their animals to receive the best in return.

On handling, for example, breeders invest in restraint cages that allow the animals to be handled with care. Docility is a genetic criterion. The absence of horn is also important because it prevents injury, for the animals between them or against the breeders. Animal welfare also depends on the welfare of the breeder.

In North America, breeders also have labels. The organic label, which takes Europe as a big part.

However, they have a specific animal welfare label for those who do not wish to switch to Agriculture Biological: the label «Animal Welfare Approved by AGW"

Illustration: Logo of the North American Animal Welfare Label.

Its specifications are to push the wellness guidelines further. Their quest for well-being was based on the Belgian Blue breed. To obtain this label, it is impossible to be a breeder of this breed in pure. They consider this breed to be an aberration of well-being since births occur by caesarean section in almost all. A cow must give birth to her calf in the most natural and unaided way possible. Their double musculature also causes problems of locomotion and the genetic heritage of this breed gives birth to calves with too large tongues, which poses a problem for them for feeding. This characteristic of double musculature constrains the animal on the possibility of expressing normal behaviors of the species.

Births are also binding because they require the breeder to do them during the summer period because, this is when the grass is the best. As a result, the mother will be able to have a generous diet and by deduction, produce as much milk as necessary for the calf during the start-up phase. In addition, warm temperatures will also benefit the calf and lead to less stress.

The "feedlot" system is obviously forbidden for this label. The conditions of numbers, the lack of hygiene and environmental standards mean that this type of breeding is prohibited. The use of growth hormones is also prohibited as well as all foods from GMO crops, a major consumer of plant protection products with properties harmful to biodiversity.

In some cases, well-being is an economic added value. The consideration of animal welfare can sometimes promote zootechnical production. It can be part of the specifications of distributors and can be a criterion for selecting suppliers. If this economic impact remains limited in France, it could change in the future due to the growing expectations of consumers for well-being. Several agricultural food processing companies in Anglo-Saxon countries are already promoting their products in the name of animal welfare.

C. Substitute meats: a native alter?

They're making a buzz right now, making the profits off the stock exchanges of the start-ups that put them forward.

On paper, these types of products are great. No methane pollution, no analyst charged suffering and no forest destruction to produce them. There are two types, one that mimics the taste of meat and is plant-based, and one that is made from animal stem cells and grown in the laboratory to form a steak.

They are intended to replace all types of animal products. Beef, chicken, pork, egg, milk...

The one from plants is a mix of several vegetables or other plants to give the appearance and taste of a real steak.

Dr. Frank Mitloehner, a professor at the University of California at Davis, met very well at the CSC, analyzed the composition of an Impossible Burger or Beyond Meat. It contains 21 or 22 highly processed ingredients. So transformed, it has trouble identifying the difference between these items and pet food. While the Ministry of Health informs us that processed or ultra-processed foods are carcinogenic, what about these products? They can contain a lot of sodium, preservatives and others whose provenance is not even known, and which are officially ultra-processed.

Illustration: Burger Beyond Meat exclusively at the Fast-Food A and G that I was able to eat

As for the products from the laboratory, this can be compared to the practices of the famous Frankenstein. Stem cell s animal s and then cultured in test tubes until you get a steak or chicken breast. Only to achieve this goal, muscle cell culture requires hormones, growth factors, fetal calf serum, antibiotics and fungicides. Then energy because they have to reproduce the heat of a body for the cells to multiply.

This is still the big unknown especially since there is no communication about the amount of oil, or the ingredients used. Artificial meats are still in the labs, they are to this day, far too expensive compared to animal meat. However, this is something that is likely to happen quickly because, large companies such as Microsoft, Amazon and many others, finance to the tune of several million. They will also fund anti-animal associations such as L214 to convince future consumers.

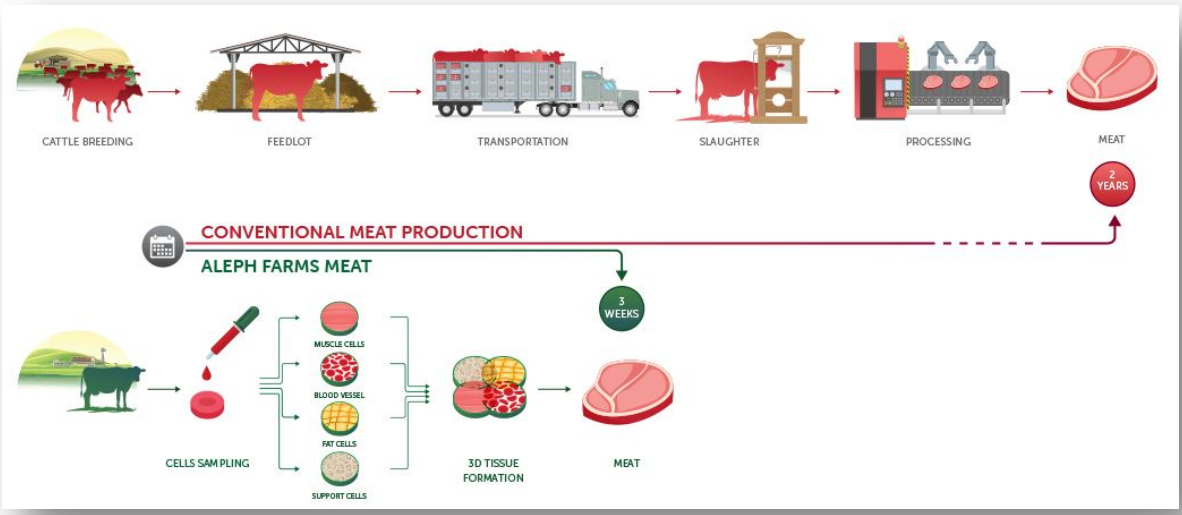


Illustration: Comparison of different meat production processes made by one of *the* industry *leaders, Aleph* Fars.

This new type of production risks upsetting the animal industry.

To date, no studies have been carried out on environmental impact and health. It may be a good way to do so that a natural product (probably carcinogenic in excess but using solar energy via photosynthesis) is not replaced by a "laboratory" product (ultra-transformed potentially carcinogenic and energy-consuming)

The few studies done on the potential of consumption in the world speaks that by 2040, this type of meat will account for 40% of the market for animal protein.

Only time can tell us what will happen in 20 years.

To conclude:

Over time, regulations have changed profoundly with the growing awareness of Man having to avoid "unnecessary" suffering and to seek optimal living conditions for animals. An important legal framework is in place, both nationally, community and internationally.

Many actions are being put in place to name a few:

- *Training for professionals to make them the first actors of animal welfare (awareness)*
- *Supporting professionals in the modernization of their structures and equipment (materials, livestock buildings...) in order to continue the evolution of animal welfare practices*
- *Strengthen vigilance in slaughterhouses (inspections, training, etc.) and help modernize slaughter equipment*
- *Do this well and let it be known through signs of identifications such as labels*

Today, new societal expectations of animal welfare are emerging such as vegetarianism, veganism or the attraction to organic. These expectations have allowed the emergence of alternative meats: "generic" meat that can be of plant origin or organic meat obtained from muscle cells. To date, despite the interest of many actors, these alternatives pose ethical, ecological and economic questions.

IV. Combining meat quality, environmental respect and animal welfare: field investigation

The challenge of tomorrow is therefore to produce quality beef that respects the environment and animal welfare. What for? Simply because it is a growing demand of the population. The butcher wants to offer quality meat to his customers and consumers are requesting. Some, consumers of organic for example, may prefer the mode of breeding that respects the environment or others, vegans or vegetarians will refuse to consume it in the name of animal welfare ...
The combination of these three aspects is rather easy in theory but in practice, this is much more complex, without counting on the economic and climatic aspect that comes into play... We will see through my various trips abroad, how farmers adapt to reconcile these 3 major issues.

A. On the European continent

1. France

I contacted **Mr. Jean Marc Jancovici**, an engineer **and former** consultant for **ADEME** for the development of the carbon footprint. He is a partner at the consulting firm Carbone 4, an independent consultant specializing in low-carbon strategy and adaptation to climate change.

To save the climate, he says, you have to eat less red meat because the cattle herd emits methane. In addition, a large part of upstream plant production is destined for their food. This plant production generates deforestation (e.g., soybeans), CO2 emissions to manufacture and transport fertilizers (often the first energy expenditure per hectare and phytosanitary), nitrogen dioxide emissions from the application of nitrogen fertilizers, and intermediate transport between fields and feed plants.

The cattle herd accounts for almost 10% of the carbon footprint in France. But most farmers are in financial difficulty and eating less meat otherwise won't do them any favors. One of the solutions to have both less cattle and more income in livestock farming would be to control farm-out prices, with the community guaranteeing, as with solar electricity, a minimum price per kilo for farmers, who would be asked in return to do things "right" (organic, label, etc.). This is the

exact opposite of what the European government is doing by putting everything and anything "in the global market.

According to Mr. Jancovici, we must both reduce our meat consumption and better pay farmers. Nevertheless, cattle emit methane, which is 28 times warmer than CO2. The practice to which farmers should be directed is precisely to favor the prairie, to ban imported soybeans also guarantee prices4 times higher per kilo.

In order to increase the incomes of farmers, Mr. Jancovici believes that it is necessary to have less intensive production (decrease in the number of heads in the herd) but also and above all a better-quality production.

This comment echoes that of Mr. Christoph Weder, a rancher in British Columbia, about obesity problems in North America. The U.S. state speaks of 40% obese and 30% of the population is overweight. North America has the highest concentration of Fast Food in the world and is the largest consumer of beef.

There obviously, quantity is preferred to quality. Currently, during the Covid19 epidemic, obese or overweight people are unfortunately in the population at risk.

2. The United Kingdom

During my visit to the United Kingdom, I visited Tim **Ling's Farm** in Wales, Row lestone, Herefordshire. I met Mr. **Tim Ling** raising Murray Greys.

According to Australian legend, the first Murray Gray was born on peter and Ena Sutherland's Thologo long property along the Murray River in New South Wales, Australia, in 1905.
The Murray Grey is the result of an imprecated cross between a Shorthon cow and an Aberdeen Angus bull. Legend has it that this one cow born from this cross gave birth to 12 calves of different colors, from which Mrs. Helen Sutherland, Peter's cousin, developed the breed. Indeed, these grey cattle probably grew faster, were excellent forage converters and produced quality carcasses with more muscles. This caught the attention of local breeders who quickly became interested in the Murrays and also began to breed them.
It was at the end of the 1940s that consciousness gradually emerged. There is something special about grey descendants... When they we represented at the Newmarket sale at a record price, it was decided that they should be given a name. The breed, which originated in the Murray area and had a grey color, was to be called «Murray Grey".

Illustration: Murray Grey Cow in building at Tim's.

Tim raises 120 cows on 120 hectares and is in organic farming. The UK label prohibits the use of maize. These cattle receive 100% grass diet, if a by grazing or by plastic wrapped. This breed adapts easily to this type of exploitation. This unique and natural food avoids a lot of problems s and metabolic diseases. His past as a dairy farmer using a lot of cereals makes him tell me that. This dairy farming experience also helped him manage the pasture. He says he does not believe in the use of fertilizer. Its manure is applied as well as lime to maintain the ph. Heis aye to graze in rotation but is a great supporter of grazing permanent and pasture in pens.

The breed is naturally hornless thanks to the Angus gene. Elle is very maternal and very docile. Because of the farm's biological status, the cattle have not been dewormed for three or four years and Mr. Ling says he does not think the cattle need treatment. At least he didn't see any changes.

Carcass level, the animals come out at the 350-380 kg carcass with an exclusively grass finish. The farm uses an external supplier to scan the eye muscles and marbling. The scanner shows that its Murray Greys are also performing well with the famous Aberdeen-Angus.

Illustration: The color of the dress varies from light to dark.

The area is suitable for livestock farming. There is about 800mm of rain per year and the thermal amplitude is low thanks to the Gulf Stream which is conducive to grass growth. Its soils are not suitable for crops and not bearing in winter. Asa result, the animals are housed in buildings and fed with wrapped boots.

Tim is very satisfied with his system. He thinks he meets all the criteria of ahigh-performing and thrifty 21stcentury. At the environmental level first because its system is low input, and the grassland is the best crop to store carbon. Then, at the level of animal welfare with the Organic Label it respects its demanding constraints. Finally, at the qualitative level because its meat meets consumer demand. His margin of progress is to improve his grasslands and finish his animals more quickly.

Illustration: Overview of Tim's buildings and forage stock.

Melview
ANGUS

For the rest of my trip to the UK, I could not miss the famous Aberdeen Angus. For this, I went to meet **Mr. Paul Westaway** in Dymock, Gloucestershire. Paul is a breeder-breeder of Aberdeen Angus at his Melview **Angus** Farm. Its farm has 150 animals on 70 hectares.
The breed comes from the aberdeenshire and Angus counties in Scotland. I had to visit a farm near its cradle.

From my first words exchanged with Paul, I quickly feel the breeder passionate about this breed. It's hard to make him have a negative side on this one. The first quality for him, is the quality of meat. He easily finds arguments by stating that it has become the number one breed in the world. It is widely used in crossbreeding, dairy or meat, to bring this marbling gene. He is not wrong; I will go to see in the rest of my travels.

However, he does not remain respectful of other races since he himself has some Murray Grey and makes it clear that this breed is half Angus.

Illustration: Paul practices a lot of competitions to make himself known and then to market his genetics.

Paul's operation is very similar to that of Tim Ling. 100% grass and use very few inputs to be as profitable as possible.
It is not organically grown but it meets many criterial. However, he is a breeder, and this makes him do a lot of embryo transplant, which the label does not allow. It sells a lot of breeders; therefore, it must be impeccable sanitary level. So here too, it applies DE parasitic products, which is not allowed in the label.

He considers it "the race of the 21st century." It meets all the criteria of a thrifty and efficient cow. Selection criteria to improve the breed its:

- Conserver calving ease
- Converting coarse and economical forages to be produced
- Strengthen the docility of the race to be easy to handle and avoid any violence bringing stress and violence
- To pug the carcass kilos without losing all the criteria listed above

Illustration: Paul's performance puts a lot of your water in the center of insemination

I will later realize that this breed is present on many continents for their qualities. However, the climate and geomorphology of the United Kingdom make it a larger and larger format.

B. On the American continent

1. The United States of America

During my time at **Leachman Cattle of Colorado,** I was able to chat and visit the farm with M. **Lee**, the inventor of the genetic concept "Stabilizer".

STABILIZER cattle are genetically based on research conducted by the U.S. Department of Agriculture (USDA) at their Animal Research Service (ARS) at the Meat Animal Research Center (MARC), Clay Center, Nebraska. This is a mixture of British and continental breeds, including Angus, Red Angus, Simmental, Gelbvieh and South Devon.

STABILIZER cattle combine the flesh capacity, marbling and moderate size of British breeds with the muscles, milk and growth of continental breeds. As a four-breed composite, STABILIZER cattle retain 75% of the F1 hybrid vigor and allow breeders to cross paths with simplicity.

The MARC (Meat Animal Research Center) launched a project in 1973 called the Germ Plasm Utilization (GPU) project. Their research has shown several benefits from crossbreeding. They showed that hybrid vigor has a significant impact on the productivity of beef cattle. Research has shown an 8% improvement in weaning weight when a purebred cow is mated to a bull of a different breed. Research has also shown that crossbred cows are much more productive than purebred cows. Benefits have come in several areas, including increased milk production, better body condition, faster reproduction and longer productive lifespan.

In total, crossbred cows weaned 23% more weight than purebred cows.

Historically, crossbreeding requires the use of complicated mating systems to maintain the hybrid vigor effect. Scientists have designed rotation systems using 3 breeds. In addition, they have caused large oscillations in breed composition and prevented breeders from having a uniform and well-adapted herd. As an alternative, MARC researchers have developed multi-race composites. Their study confirmed that these composite breeds retain hybrid vigor in proportion to the number of breeds used, the use of more breeds generates more retention of hybrid vigor. STABILIZER cattle (originally known as Marc II composites), with four breeds, retain 75% of the F1 hybrid vigor. Thus, breeders can breed composite bulls to composite females and retain most of

the available hybrid vigor without the complexity and loss of uniformity associated with crossbreeding.

The objective of the program is to improve the economic efficiency of lactating cows and the production of consistent and low-cost beef from forage-based systems. The result is a new index, the $Profit index.

Illustration: Stabilizers bull in Leachman Cattle of Colorado.
Cattle are black or red due to the dominant genes *of Angus.*

The profit$ includes almost all indexes that have an impact on profitability. The effect of most aspects on profit is quite simple to understand. Here is the list of what is included and its effect:

Income *traits*

- Ease of calving - more calves alive and vigorous at birth
- EPD (Expected Progeny Difference) of Weaning and One Year - Fast Growth
- Fertility (days before conception) - more calves, therefore more meat produced
- Carcass weight - higher value up to 1050 lbs.
- Marbling (meat marble) - assessed according to market premiums
- Rib eye area - value as an impact on yield content
- % Retail product - more quantity and weight therefore more meat

Traits on the cost of production

- The size of the adult cow - usually larger because it eats more
- Renewal - too many cull cows cost more
- Efficiency of feedlot feeding - reducing food costs

However, some aspects are not as easy to characterize for the $ Profit. Milk, for example, is a good thing until you take too much. More than 25, milk EPD has a more negative effect on fertility

than on weaning weight. There are a few traits that are not yet included in $ Profit: longevity, structure and docility. These traits are important but difficult to express in dollars.

It is to be known that in the United States, we are talking about a concept, whereas in Europe, the Stabilizers is more considered a race.

Its concept would respond to many of the problems seen previously. The combination of different breeds would allow for a very food efficient animal so fewer resources will be needed to obtain a Choice class carcass. The breed would be rustic and could adapt to all environments and breeding methods.

For Lee, as a good businessman, the past was Hereford, the present is Angus, the future will be Stabilize!

In Colorado, I also visited **Mr. Kit Pharo's** ranch in Cheyenne Wells. Kit operates a 11,000ha **Pharo Cattle Company** ranch with 4,000 cows of different breeds. He is primarily a breeder and sells about 1,000 bulls each year. The climate is called "steppe." Rainfall is 400 mm on average and the region has 5 months of the year with temperatures are negative.

Its philosophy is to find the optimal size that is more cost effective than the maximum size. The "Book per acre» or kilo per hectare determines the profitability of a farm. Not the pounds per animal. The goal is profit. The ideal size of a cow is 50 inches, 127 cm at the withers and 54 inches for a bull (138cm). Beyond that, it will only bae problem animal that will have to be supplemented or cared for, which will make it lose profitability.

To achieve optimal production, **it is the cows that** must be **adapted to their** environment and not the breeder **to** change the environment to adapt to **the cows.** Because many breeders have inefficient (too large) cows, they are forced to change their environment by providing food harvested or purchased to keep their cows in production. Kit is looking for a cow that can survive strictly on what the ranch produces, with little or no additional inputs. A cow must support the ranch, not be supported by the ranch. It selects cows that thrive in "native" shortgrass meadows with almost no hay supplement (only in extreme snow weather) and no food or cereal. Cows have to produce and wean a calf every year or they are slaughtered. No second chances.

Not all breeds have the biological type that can meet the requirements established by its philosophy. He studied many different breeds to find cattle with the biological type most suited to his environment and philosophy. He focused on low-maintenance cattle with strong maternal

traits. Its breeding program includes Red Angus, Black Angus, Hereford, Tarentaise, Mashona, as well as composites of these breeds.

Kit noticed that the more weight he increased at weaning, the more difficult it was for him to make a profit. With each increase in weight, he sees an increase in his expenses. He learned to make the crucial difference between the kilos of **production** per **animal** and the kilos of **production** per **hectare.**

He then worked on reducing costs by using every drop of rain and sunshine as efficiently as possible. This involves three distinct management practices:

1. Use of a rotating grazing system, which allows time for grasslands to rest and grow during the growing season.
2. Unaided calving, in sync with nature, which matches the highest nutritional requirements of cows to the highest and best pasture production.
3. Produce metabolically efficient and highly fertile cows that can survive strictly on what the ranch produces with minimal or no inputs, while producing one calf per year.

"Herd Leave". Pharo Cattle Company invented this philosophy to essentially mean «think for yourself." He uses the term "A herd quitter" to refer to people who have the courage to break with the industry status quo. Following the crowd is not necessarily the best way to manage your breeding. More and more ranchers are "leaving" the herd. They have "left" the conventional status quo herd of unsustainable, high-yielding agriculture. Kit that agriculture must be both profitable and enjoyable to be sustainable. He talks about converting free solar energy into a protein-rich and tasty food product. And if it's done right, the cow will do almost all the work.

Even if it is visible and it is not so difficult to understand, most producers will not change until they have to change. Most people hate change. They are afraid to detach themselves from a defined model of livestock. Kit seeks to make farmers aware of the difficulties of the sector and wants farmers to focus on building fun, profitable and sustainable model for beef production.

"Leaving the herd" also means having autonomous animals, able to fend for themselves without human intervention so that the breeder is not permanently with them and can have free time for his family and leisure.

Illustration: In the middle of February, Kit's pregnant cows in their nutrient-poor pastures

During this visit, I could see that the animals are left to their own devices and must survive in very difficult conditions. The photo above shows the lack of grass available and its poor nutritional quality. The ground is frozen, and the vegetation is toasted. There is indeed no supplementation for these pregnant cows, nor shelter for that matter. However, they show no signs of ill-being and are very docile. Its fleet of equipment consists of a tractor with a 90hp front end and a pick-up truck to unroll the haystacks on snowy days.

Illustration: Pick-up, 90hp tractor and no *other equipment*

Any breeding problem must be solved by genetics. Currently, he is working on the resistance to flies and maladies that they can bring.

"We need to change the cow, NOT the environment!"

His philosophy is not just folklore because Kit sells about 1000 bulls a year at an average of $3,000 and ranks in the Top 10 of the Top 100 of the country's biggest breeders each year. Ranking that starts at 215 bulls sold.

This ranch made a strong impression on me by the extreme conditions and driving that Kit practices. It's obviously not all about feedlots, hormones and GMO in the United States!

2. Le Canada

Mr. Steve Canyon in Busby, Alberta, Canada, leases the **Greener Pastures Ranching LTD.** 1,200 ha for about 1,200 cattle.

GREENER PASTURES RANCHING LTD.

He does not own these and, he takes them in pension on behalf of other breeders who cannot or do not wish to manage the breeding part. These are excluded from the heifers in gestation who will return to their owners once the date of the term is near.

Greener Pastures Ranching's **philosophy is "Economic and environmental sustainability for** generations." He believes that for a company to be financially sustainable, it must also be environmentally friendly.

The main operation, or profit center as he likes to call it from his ranch is custom grazing throughout the summer. It operates a flexible number of cattle using intensive rotational grazing management. By rotating grazing, it improves biodiversity in its pastures, improves soil life, improves the carbon storage capacity of its grasslands and improves wetlands. As a result, he raises his animals in a healthy and natural way. A way that reduces the need for many chemicals, by producing quality the meat that is richer in omega 3, vitamins and nutrients than conventionally high products.

Biodiversity is his trade fund because he works on the restructuring of soils by the diversity of plants in his pastures. He works on the association of a multitude of plants and cereals. Its aim is to promote biodiversity as much as possible. He tests various plants and cereals to see their developments in combination and sees if the cattle will lories them by their ingestions. Not using any agricultural machinery, semi made by a supplier and on the fly to minimize the costs of testing the germinative power as well as the competitive ability of different species. Cows that act as grounding by their sabot to ensure seed-to-ground contact.

Steve promotes flowering plants for pollinators and places bat nest boxes to test the regulation of flies on cows.

Illustration: Steve Kenyon in his test plot. 21 different species sown.

He also works with the University of Alberta on carbon sequestration from its grasslands compared to a forest. However, the results are not known to date, the study covers 5 years.

His passion for the land and the animals that depend on it for their survival led him to teach his practices and write articles in The Canadian Cattleman, The Stockman Grass Farmer and The Blade. He also speaks at conferences across North America schoolman seminars. It seeks to help other farmers improve their current agricultural businesses. It encourages people who are considering farming to have a career and a way of life.

Illustration: University of Alberta's feature on Steve prairie carbon sequestration.

During my trip, I also visited **Mr. Christoph Weder's home** in Hudson 'Hope, British Columbia at the sin of his ranch «**Venator Ranches LTD.».** I had already met Christoph during the CSC in the United States because he too is a Nuffield Scholar 2019 for his country Canada.

His ranch spans 14,100hours, of which 250 hectares he leases to the government during the vegetative period. He removes his animals during the winter to leave them free to nature. It breeds 1,800 cattle, 90% of which are Angus and 800 American bison.

For him, the maintenance of biodiversity is one of his main objectives in parallel with the production of beef. British Columbia is very rich in biodiversity. This area is very sparsely populated and has left a lot of room for nature.

Its cattle and bison are bred in cohabitation with many wild animals. His animals have access to pastures and forests. Deer, elk, black bear, grizzly bear, wolverine, raccoon s raccoon, squirrels, wolves, ... and many of the animals are in cohabitation with animals. He works on respecting the wetlands present on his ranch as they are home to a lot of biodiversity. He is struggling to have this work of biodiversity protection recognized by the Canadian government for service to society because humanity needs nature to live. **It easily reminds us that man is a product of nature and not the other way around!**

Despite the presence of many predators, it encounters little attack. When I talk to him about the reintroduction of bears and wolves in France, that this poses a lot of problems for breeders, he tells me that it is a problem of balance. Predators rarely prey on cattle because they find enough natural prey and therefore do not need to attack cows, let alone a bison. For a wolf or bear, a bison is a threat because they can inflict serious injury or even death. A deer or deer will be less risky.

However, he acknowledges that wolves take about thirty calves a year, about 1.5%. Derisory in view of the number of predators. He says he pays the "tax" to wildlife. The bear is omnivorous, but its diet is not exclusively meat. It will find a balance and will not systematically attack livestock.

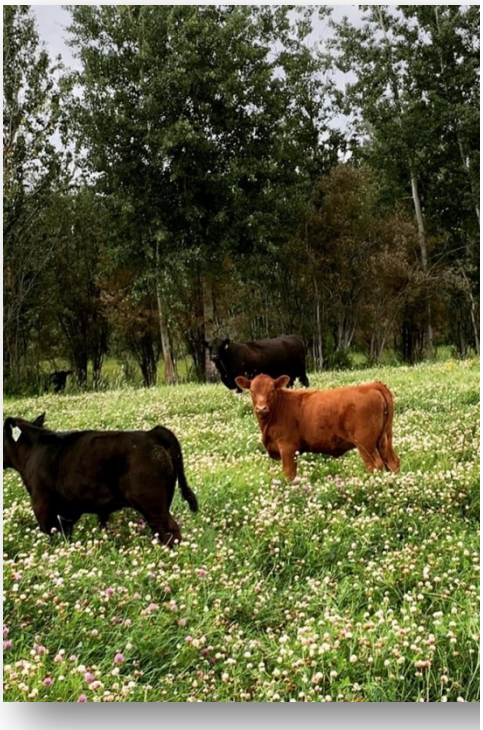


Illustration: Floral and wildlife diversity *at Venator Ranches LTD in British Columbia.*

Christoph works a lot on grass feed marketing. These animals are fed exclusively on grass. I find in his speech a philosophy of Pharo Cattle Company.

Its ranch philosophy is simplified to the maximum to be restabled in a low input system. The cattle have to work for them, so it is important that they have the right type of cows. His Angus herd was bred and selected in the Old-World Grass Based Angus Genetics. He believes that the North American angus cattle went too far from what it was intended for. For many students, it's all about grain and high-energy rations. He had to look for genes to find the ultimate "grass converters he wanted. He came into contact with a group of New Zealand breeders who had this vision and who remained faithful to the breed without following all the trends and trends that followed.

Its system is simplified to the maximum. Every dollar spent has to be thought through. For this reason, very little outdoor purchase including salt for mineral alone. Phosphor, calcium, magnesium, are naturally present in its meadows. He buys hay but for him it's not just a food purchase.

He considers him a fertilizer because he practices Bale Grazing. This involves leaving the haystacks on the plot and letting the animals eat them in the winter. What will not be consumed and left on the ground will serve as a fertilizer. It's an intake of organic matter. It is only one cut of hay grass, the vegetative period being short. The boots will be left on site and bound with a biodegradable string made from vegetable fiber. In this way, there will be no work to remove these strings. When winter is expected, cattle will consume hay. No manipulation once the boot gets out of the round baller.

Illustration: Cows and bison graze the second cup. They won't touch the haystacks until winter. Fresh grass being more palatious.

Christoph also breeds bison. He is passionate about this iconic animal. While man seeks to shape cattle in his image to make it better, bison take advantage of thousands of years of genetics and natural selection to be at the top of acclimatization in this environment. In its philosophy of simplification, bison is the ideal! Rustic and almost without intervention, the bison is totally independent.

Christoph and his family are nature lovers. They created a ranch in total harmony with nature by reconciling respect for animal welfare and respect for the environmental. All associated with an exceptional quality of meat "to my taste" since I was able to taste it. I spent 3 days in his "kingdom" as he calls it, and it was very rewarding!

C. On the African continent

In the particular conditions of South Africa, I became interested in the Beefmaster concept. For that, **Mr. Frans Odendaal** and his wife, in Vrede, opened the doors of their ranch «WO Beefmasters**"** tome. Frans operates a 7,000-hectare ranch, including 700 in corn, 600 in soybeans and 1,600 cows.

The man behind this breed is Tom Lasater who began developing the Beefmaster at Texas in the 1940s. The Beefmaster was thus created by an intensive program of crossbreeding between:

- Brahman Cows and Hereford Bulls
- Hereford cows and Brahman bulls

- Shorthorn cows and Brahman bulls

The best crossbred animals have been selected for later breeding, using the "Six Essentials". The descendants of this above were raised in a three-lane crossing. This led to a new breed of cattle known as Beefmaster. From the start, the selection was based solely on economically important characters.

Illustration: Taurus Beefmaster

The first principle is to select only for the <u>six essential elements:</u> docility, fertility, weight, conformation, milk production and hardiness. Long-term goals must be clearly defined, rigorously limited and ruthlessly executed. The immediate goal of any effective breeding program is to make each generation obsolete as quickly as possible. The Six Essentials are the standard of excellence against which Tom Lasater evaluates his cattle. These are the cornerstones of his breeding philosophy. The more limited the goals, the faster they can be achieved.

The second principle is to aim for reproductive efficiency. Until the calf is standing in the weaning pen, everything else is theory. Reproductive efficiency involves weaning a high percentage of calves while using certain practices of retaining 80% or more of each heifer and breeding them around 13 months over a short season of 65 days or less.

The third principle is to test performance in a constant environment. Tom Lasater has often said, "Cattle must be born to be raised, tested and sold under the conditions in which it will be produced." If there were a breeder with equal abilities in each geographic area, it would not be necessary to move the breeding herd over a long distance.

The fourth principle is to use direct selection, which means selecting for the specific characters you are looking for and not for a combination that the breeder hopes to produce. If the weight is desired, it should be selected using ladders and not trying to "globalize" livestock. The heritability rate is of little importance in a selection program. If fertility is desired, it should be selected independently; At the same time, if a line is not necessary, do not select it. In 1925, E Parmalee Prentice was asked what the American dairy cow of the future would look like. He defined the direct selection when he replied: "She will look like a cow that gives a lot of milk."

The fifth principle is to use the adaptive powers of nature. Tom Lasater's policy is to ask for the impossible. However, he acknowledges that his "credit" with nature is limited. He therefore limits his requests accordingly. For example, if replacement heifers are required to calve at twenty-four months of age and weave a heavy calf in the same year and each subsequent year, these calves should not be required to have some hair color or other irrelevant characteristics.

Illustration: Beefmaster Cows. The color of the dress is not a criterion of selection; therefore, the herds are several red hues.

Beefmaster, purebred or percentage, adds disease tolerance, insect tolerance, heat tolerance, longevity, docility, calving ease, maternal abilities and hardiness.

This concept of crossbreeding is similar to the Stabilize but rather intended for warm and tropical countries.

Frans tries to feed his animals exclusively grass to be as profitable as possible, only the climatic conditions of this country make the dry season a milestone that must be passed. As a result, during this season, he complements his animals with cereals produced on the farm. Corn and soybeans to cover energy and protein needs. For fiber, the animals will consume the dry grass still present.

As South Africa is the most developed country in Africa, it is still a developing country. The concept of organic farming is non-existent. Frans has "heard about it" and there is no demand in the markets. Respect for the environment is not a government priority. Here, we have to start by feeding the population, the rest, we'll see later!

As a result, GMOs are used on his ranch. The concept of animal welfare is also not recognized despite Frans taking care of his animals.

Susan Scheepers and her Afrikaners

Susan Sheepers manages a commercial herd of 1,000 Afrikaner animals with 500 breeding cows on 3,000 ha in Stoffberg, Mpumalanga. Susan's ranch is very difficult. Breeding conditions are harsh and for this reason she chose the Afrikaner. Its load is one cow for 3 hectares. Susan targets medium-framed animals with solid legs and feet suitable for walking long distances on rocky terrain. In winter, the herd walks 25 km to its Luiperdshoek farm in Steelpoort, then returns to Stoffberg in the spring. Therefore, she selects on docility because this transhumance requires brave and calm animals.

In this region, it's **the survival of the fittest,** Susan tells me. In an area where heart disease, bile fever, gall and also blue ticks are rife, the longer the hairs, the greater the problem.
That's why the smooth mantle and thick skin of the Afrikaner make it the ideal choice. Animals receive a deworming injection in November to keep them tick-free in December and January, a wet period.

The resistance to Afrikaner disease is so good that it rarely loses an animal, even in the event of a severe outbreak of blue ticks as there has been this season due to late rain. Whether it's cold winters or hot summers, the Afrikaner is resistant in all conditions due to its exceptional robustness and adaptation.

Predation is another problem. The leopard, the hyena and the jackal are the main culprits. The herd is spread over a large area and has to fend for itself. Any other breed would be difficult to manage under these conditions, but the Afrikaner's exceptional maternal instinct comes into play and a cow will fiercely defend her calf. In this extensive system, choosing an easy-calving breed that breeds its calf alone is a crucial choice. Animals are not skinned because horns are essential for the calf's defense against predators.

Last year, it was the black Mamba that caused lot of losses. This snake does not attack the animals, but it is during the movements that the cows walk on the tail, the animal turns and inflicts a fatal bite on the cattle.

Susan is looking for medium-sized cows, weighing between 450 kg and 500 kg, who can wean a calf at seven months at 50% of her body weight and this every year. The rest for its grazers, will be the feedlot.

The breed is very fertile and lives a very long time. Its renewal rate is low, in the order of 10%. However, the breed is not early, the first calving is around 3 years old. To do this, and to improve the quality of the carcasses, Susan begins to try to cross her animals with Boran and Brahman. These two breeds have similar abilities to the Afrikaners. It relies on the Boran, native to Ethiopia, to bring tenderness and on the Brahman, native to India, for more kilo and precocity.

Illustration: Susan's flock in the arid plains of the dry *season.*

Susan and Frans are unanimous that life in South Africa remains complicated politically. Nelson Mandela transition to power has made a big difference, but corruption and racial quarrels are still present. Because of their European origins, they are aware that they could do much better, but their efforts will be a drop in the bucket until there is a big change in the major government bodies.

D. On the continent of Oceania

I had planned to visit only the South Island where I had to meet my CSC roommate, Mr. **Corrigan Sowman.** He lives in Takaka, Golden Bay. Corrigan is a dairy farmer, nothing to do with my subject but I wanted to see him again because I had very much sympathized with him. A great opportunity to see how the famous cruiser, the Kiwi, works. His cows are all Kiwi-type. A cross between Holstein and Jersey. The goal is to have a productive, rustic and thrifty cow.

Corrigan raises 700 dairy cows on 400 hectares. System exclusively to grass but intensive because the load is high. New Zealand's climatic conditions are very conducive to grass growth. The most economical culture and the only alternative to be competitive in the world markets. Rainfall is high, around 2000 mm/year and temperatures between 5 and 25 degrees Celsius. Perfect conditions for grass farming.

Illustration: Corrigan Kiwi Dairy Cows in Golden Bay.

However, Corrigan tells me that he is feeling the effects of climate change. The driest period is getting longer and longer and to maintain its production, irrigation is forced. Initially it was only one to two weeks a year but now this period has lengthened to one month. Its climate is very influenced by the ocean and I am aware that something is happening at the level of the ocean currents which, by implication, have an influence on its production. Corrigan tells me that things have changed in New Zealand. The image of cows and sheep as far as the eye can see, it's not like that anymore. The dairy industry has grown strongly and is putting pressure on other farms. As a result, the image of a very ecological country has deteriorated because dairy production is not done in an environmentally friendly way. Their export-oriented, global-based systems require them to be more intensive. As a result, cattle loads raised per hectare are beginning to have an impact on the military. So, nitrates are found in aquifers and rivers. Under irrigation, it is not uncommon for herders to put 400 units of nitrogen per hectare per year. If they are not paid more attention, the image of an ecological country may change in the eyes of the world.

Illustration: Prairie irrigation at Corrigan.

This visit to a dairy farm reminds me of some memories... However, that is not the purpose of my visit. I enjoy being with Corrigan who gives me the contact of a meat breeder in the south near where I have to go. Perfect, here I am with another visit, so 3 for the rest of my stay.

I thank Corrigan and his wife for the welcome and accommodation and then head south.

The rest was a little different from what I had planned. After a few days of driving, I stop on Queenstown and then go to Gore. But the weather was changing, and it started to rain... ropes! For 2 days non-stop, rain to the point of flooding. The city of Gore was cut off from the world without

electricity. I couldn’t reach my 2 contacts to finalize the visit time. Result: 1,000mm in 60 hours... Incredible! I can't get to Gore to get to my contact. At best, temporary rivers or rivers blocked at worst, roads were washed away.

Illustration: Test of the ability to ford my 4X4 after passing a tractor through the "ephemeral rivers" of Nouvelle Zealand

In my misfortune, I found myself all the same, stuck on the right-side. I took the northbound route to Hamish Murray, Nuffield Scholar 2019 (New Zealand) also met at the CSC in Ames.

However, here too, change of program in the road. Hamish finds himself overworked and apologizes for not being able to receive me. Lambing periods and is the only one to manage s3 children. It is Sold-out.

Here I am without any more appointments... I am undertaking a last-minute search, but here too, between lambing, sheep shearing and administrative requirements, New Zealand farmers are particularly busy.

I decide not to contact the breeders anymore and to go to their homes, unexpectedly so as not to be refused by phone or email.

BRACKENFIELD
ANGUS
EST 1942

Finally, I go to **Mr. Angus Brackenfield** in Seddon. Surprise, the technique is paid. Caught a little off guard and busy in the shearing of his 5,000 Merino sheep, Angus finds the visit of a French breeder amazing and interesting and agrees to show me around his breeding.

His ranch has 650ha of pasture for his sheep and 500 head of cattle. It also has 650ha of vines of the famous New Zealand Marlborough wine.

Angus raises ... Angus. Obviously, a predilection.

He chose Angus for the same reasons as many of the breeders he had previously met. Its breeding system is extensive. Little or no input, a chemical weedkiller applied to the helicopter on the dirtiest plots.

The climate is drier than Corrigan, only 700mm per year. There is a well-marked dry season. However, irrigation for a meat farm will be too expensive. It only practices on small areas where breeding bulls are placed.

Illustration: Angus heifer in dry meadows.

The quality of Angus's meat and its "Only Grass Feed" diet allows it to find more profitable outlets.

Illustration: Breeding bulls sold at the next annual sale held on the *farm*

I find the same selection criteria as in the other Angus farms previously visited. The breed adapts very well to the environment and the export market, mainly Asian.

Angus knows the Organic Agriculture system and is not far from meeting its criteria but there is no demand. As in North America, switching to this type of production does not give it any

advantage. This leads to more administrative constraints to generate no valuation and without counting any help for the version or maintenance as in France.

Angus lets me know that beef and sheep cattle farming in New Zealand still knows how to stay in an eco-friendly and animal-friendly environment. As the dairy industry begins to cross the line. The government knows this and as seen before, is working on restrictions because the country is also very touristic. The image of cows and sheep as far as the eye can see in New Zealand must perpetuate.

To conclude:

Through these visits abroad, I was able to *see* different *ways of producing beef. The latter differ depending on climate, topography or geopolitical constraints. However,* farmers *seek to* produce quality *meat* that *meets* consumer *and* industry *demand. These women and* men who have *graciously* opened *their por*tress to *me, have the taste* of *breeding,* respect for *the animal* and the *environment* because they know that to get *the best, you have to give the best.*

Conclusion

This Nuffield experience has allowed me to gain a solid knowledge of cattle farming in general. I have observed farming patterns in extreme conditions and others in more accommodating conditions.

In order to adapt and develop, breeders use several levers, including genetics, which is certainly the most important part. As the workforce becomes scarcer, they have been able to develop animals that can be very autonomous while remaining efficient. Regardless of the breed chosen, it is the main result that one breed will adapt better than another. Angus or Hereford, for example, are very well represented in the world. It is the selection patterns that make the Colorado s or Gloucestershire Committed s different. Each of them has a format adapted to what the region is able to provide them. All this, while maintaining the taste quality appreciated by the consumer at the expense of volume which can be penalizing economically for the breeder. Some have chosen the cross to benefit from the best genes of different breeds. This remains a challenge because, if the first generation is excellent (F1), retaining the heterosis effect remains complicated for the suaveness. In addition, re-emerging an unwanted gene is not excluded. However, to make pure breeds, you have to grow and grow, you need pure breeds... This is the art of the geneticist.

However, the economic aspect not mentioned in my problem is something very important. Indeed, this is the final price given to the breeder and the cost of production that will ensure its profitability and therefore its sustainability as well as the future of its ranch or farm. The grass-based diet remains the most economical. Genetics will cause cattle to becomes-grass converters and thus avoid the addition of expensive dietary supplements as possible. As grass is a pre-food for cattle, there will be fewer health problems and therefore fewer veterinary costs. In addition, many countries highlight, through several studies, the final quality of meat from cattle that have consumed only grass.

Fatty or lean meat will also be worked according to the different genetic heritages of the breeds.

Grass will also promote ecology because grasslands are formidable sinks of essential carbons to combat global warming. The cultivation of herbs promotes biodiversity through the different plants that cattle can value and turn into meat. The prairie is a natural biotope where a large fauna develops on several levels, whether in the soil (earthworms and other microorganisms) or on the ground with different animals constituting a natural food chain.

Marketing and marketing are made easier to achieve and justify. The image of a happy cow grazing grass to ruminate under the shade of a tree will be significantly more «seller" than a cow raised in a building or feedlot with a monogastric type diet.

France is not a bad student, however. The feed consists of 80% coarse fodder. However, some selection schemes have made some breeds, reals «flour mill" coven some cancel them. This direction was certainly taken by economic choice because the industry established a payment grid based on the conformation of highly developed carcasses and difficult to obtain with a diet composed exclusively of grass. This has made the job more complex and difficult. Today, the

company is looking for more comfort, a reduction in working time and holidays... which makes the profession become less and less attractive to new generations.

However, some breeders have been able to give new impetus to more rustic and economical breeds with short circuits for consumers concerned about their food and the origin of the products. They manage to earn an income with breeds that, however, are not favored by the EUROPA grid.

France has a large pool of cattle breeds recognized in the world. Themed age of our regions has been able to create breeds adapted to several environments from the seaside to the mountains through the plains. INRA has been able to create a very consistent breed that meets the E of the EUROPA grid with INRA 95. Perhaps he should try to make a new breed more economical and greener with a more selling name like for example "La Gauloise".

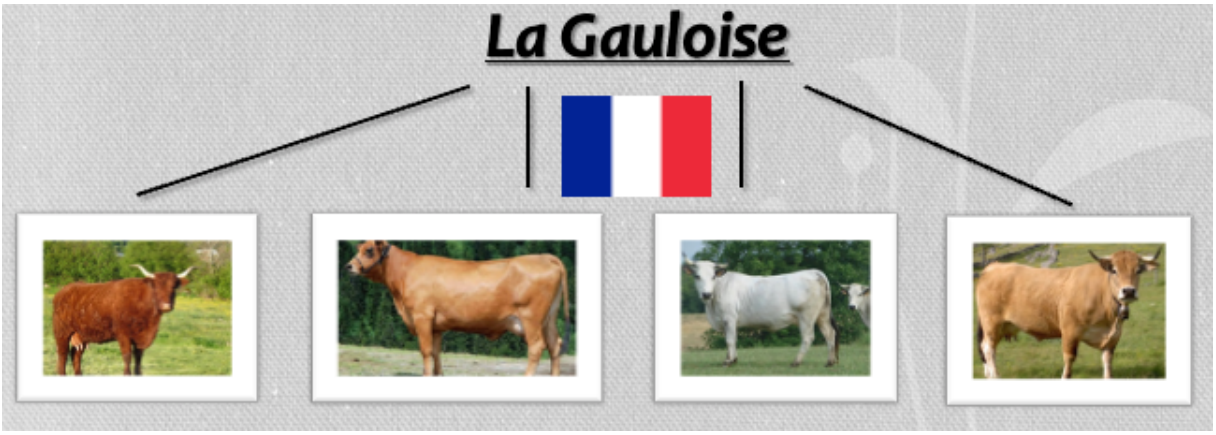


Illustration: a quick example of a French-style crossing with the objective of a rustic, fertile, docile breed, valuing only grass and with *tasty meat. Short... The perfect cow!*

The agreement to be a farmer and a grain farmer would also lead to an evolution. Rather than producing a grain that will use hydrocarbons, chemical fertilizers and plant protection products (which will have to be dried, stored, processed and transported to a building that houses cattle), would there not be a possibility that these grain farmers would setup multi-species grasslands? Thus, grain farmers could let the animals of farmers feed, which in exchange will fertilize the soil of grain farmers.

The organic system, which prohibits any chemical and artificial product, is fully aware of this. Pring organic in large cooking without organic input is currently not possible. The organic system that would be sufficient for its own breeding is a utopia.

In conclusion, cattle farming faces difficulties but has the capacity to cope. It is also the consumer who must realize that a healthy and natural product has a price and that it must give priority to important things such as quality, respect for animal welfare and theenvironment. When a meat is cheap, it is the animal that pays the difference by its suffering in livestock and the environment by its destruction. We have only one planet and humanity are a creation of nature. Lately, the pandemic of the Covid-19 gave us a nice reminder...

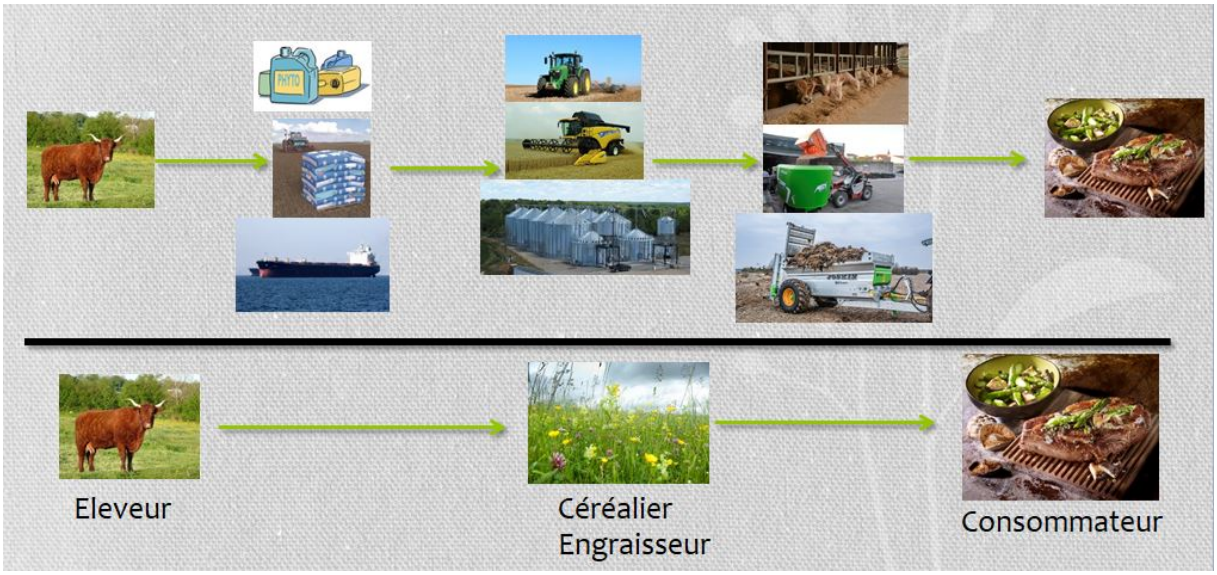


Illustration: Farmer-grain relationship *to date and more environmentally friendly.*