Responsible animal production systems

INRA – ATF – EAAP Special session

J.L. Peyraud

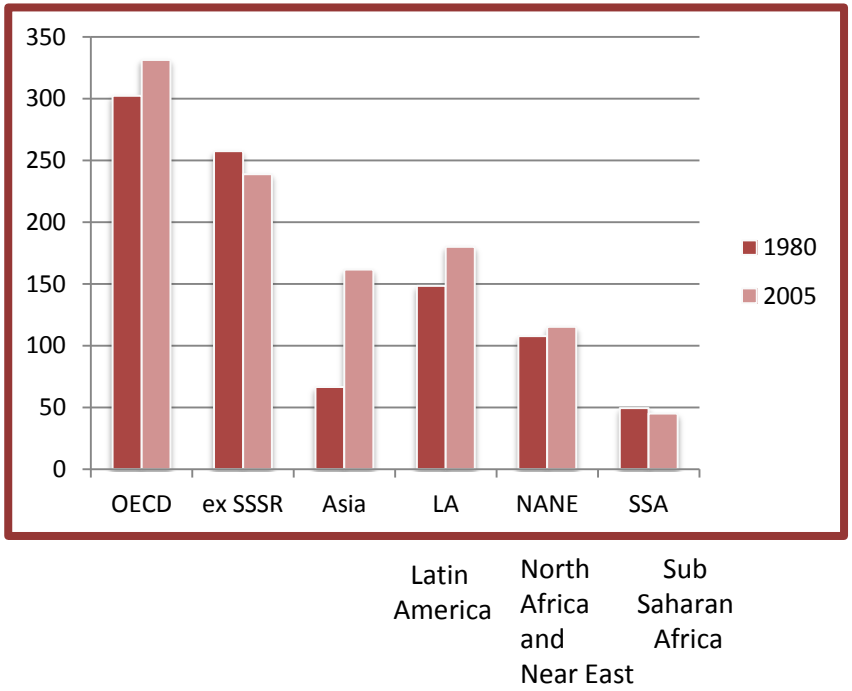
27/ 08 / 2013

The challenges for animal production systems

The evolution of world demand for animal products (1)

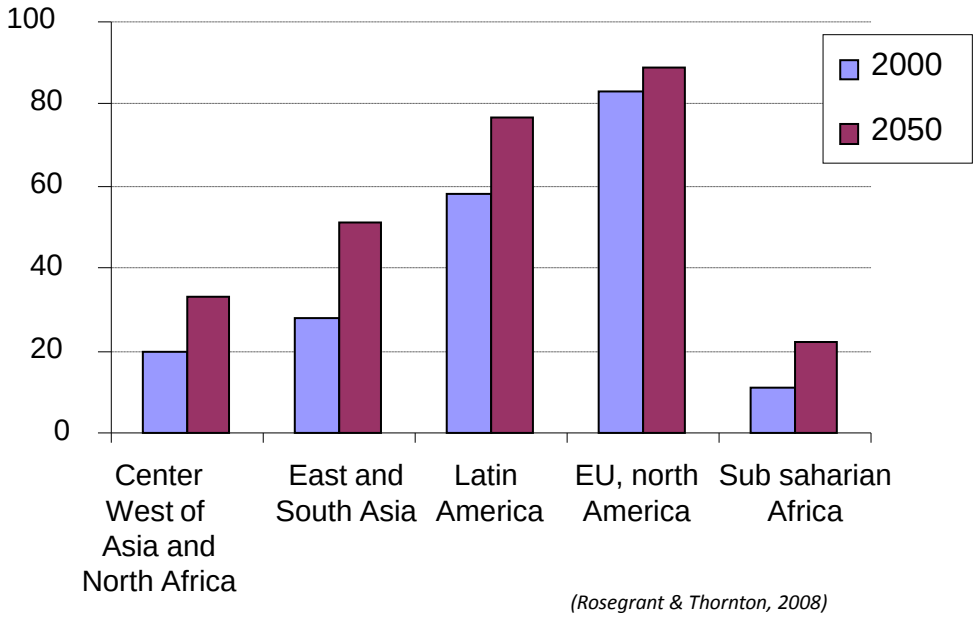
- **Increasing demand in the world : A doubling of demand for animal products is expected for 2050 (demography, consumption per capita, incomes)**

C in Kg/inhabitant/year (meat + milk + eggs)



(FAO, 2009)

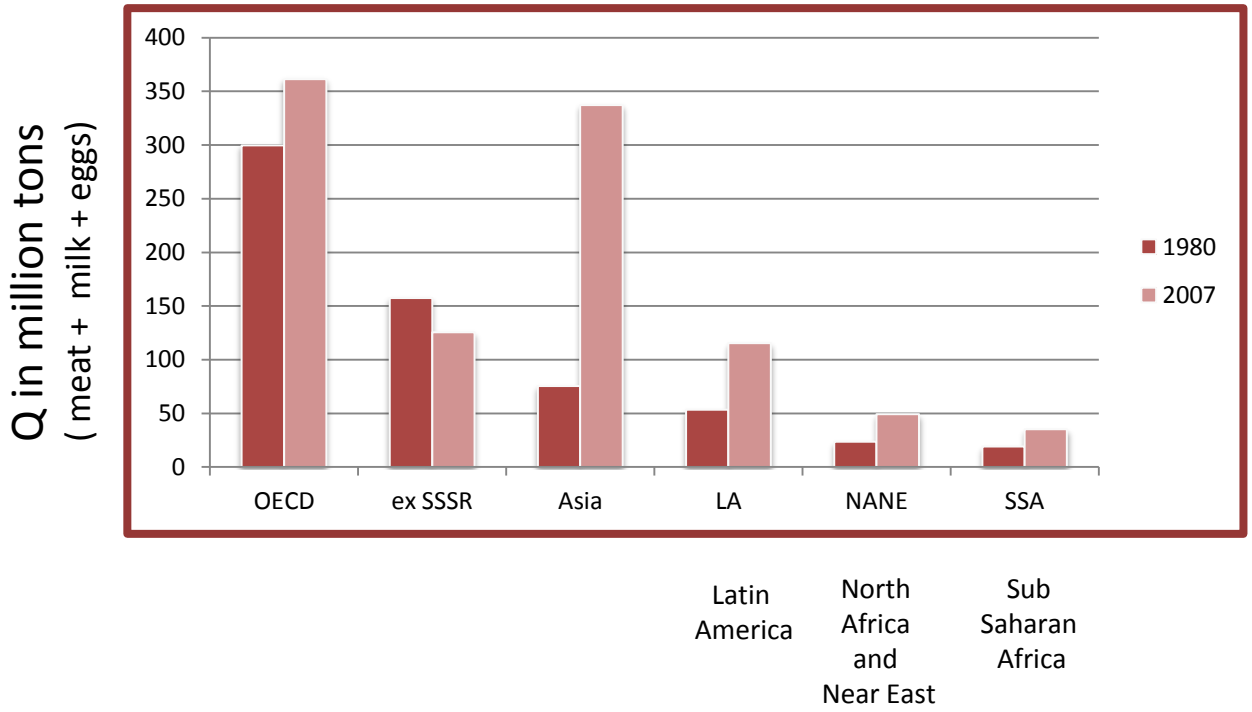
Kg/inhabitant/year



(Rosegrant & Thornton, 2008)

The evolution of world animal product consumption and production (2)

- **An increasing production to face an increasing demand :**
  Dominance of poultry and pig meat in driving the increase in global meat consumption



(FAO, 2009)

- **Strong challenges are related to the increased demand and production**

Animal production systems produce negative services

- **The livestock sector use 30% of frost free land**
  - Permanent pasture : 26% of emerged frost free land
  - 35% of crop production is used as animal feed (high demand in developing countries)
- **The livestock sector is responsible for 18% of the GHG emission**

(FAO, 2006)

- **The livestock sector use 20 % of the total water**
  - 150 to 550 kg water (surface and ground water) / kg meat vs 200 kg cereals
  - large variations among territories and systems
- **The livestock sector is the largest source of reactive N emission (nitrates, N2O, NH3)**
- **The livestock sector is the driver for deforestation**
  - To generate pasture (this is lessening) and soya production
- **Animal welfare in intensive systems is socially questioned**

But, animal production systems also provide various positive services

- **Economic role**
  - 1.3 billions jobs
  - 33% of the agricultural sector (1.4 trillion US$)
- **Production of environmental benefits**
  - Permanent pasture contribute to the preservation of biodiversity and the quality of water (not too intensively managed)
  - Use of land area which is not suitable for production of food
- **Production of healthy food**
  - High nutritional quality of animal protein (digestibility, Essential AA profile)
  - Micronutrient : Iron…
- **Cultural heritage**
  - Preservation of landscape diversity and aesthetic, tourism, living rural territories
- **In traditional societies**
  - Provide incomes for 600 millions small scales farmers
  - Livestock help to intensify agriculture, allow trade and accumulation

Finally

- **Animal production systems are considered as a major cause of environmental problems and are under pressure**

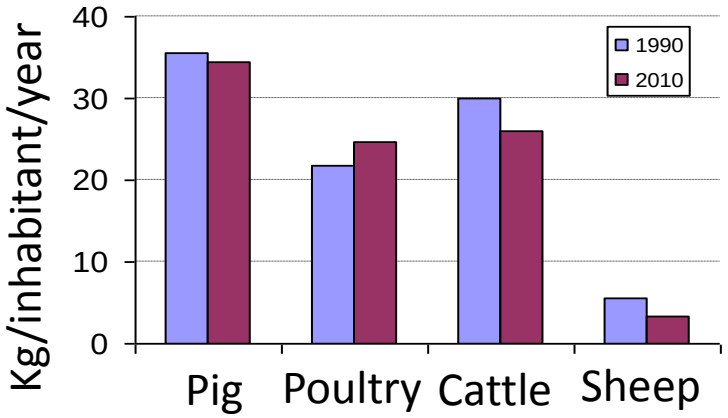
- **The situation is more nuanced than what is often said**

  Positive vs negative services

- **The problem is that these positive services are poorly or not at all valued by the market (prices) or by direct payment (CAP)**

Animal production systems in Europe

- **The stakes are similar**
  - **The livestock sector contributes substantially to the EU bio economy (130 billion € annually, 48% of the total agricultural activity)**
  - **The livestock sector largely contributes to harmful emission**
  - **50% of the protein used in intensive animal production systems (apart forages) are imported (Soy)**
  - **Livestock farming systems largely differ between regions**
- **But the demand for animal product do not (or hardly) increase and profits are lower for stockbreeders than for cereal farmers**



Profits before taxes	K€/UMO
Crops	**80**
Pig & Poultry	**45**
Dairy cows	**27**
Cattle	**15**

The options

➢ Consumption

- Overconsumption in certain countries / groups (not in EU?)
- Shift to low impact products / diets
- Consider the “Food transition” process : less cereal and vegetables, more meat, sugar and lipids

OR/AND

➢ Multi performing animal production systems

- Improving efficiency of conversion of resource (land, nutrient, energy, water) into animal products
- Reducing looses
- Maximising the positive impacts (grassland….)
- Ensuring animal heath and well-being

A responsible animal production system should embrace

➢ The profit dimension

- Cost/benefit ratio: cost are involved in repairing damages done to ecosystem health
- Enhance resilience / unforeseen events (economy, climate, health)

➢ The environmental / planet dimension

- Minimise use of natural resources (water, energy, P) and chemical additives
- Minimise water (nitrate, pesticides, antibiotics…) and air pollution (GHG, odours, ammonia…)
- Minimise the C footprint of animal products
- Increase protein and energy autonomy
- Not lead to a decrease in biodiversity,
- Not lead to land degradation and de-forestation
- Respect landscape diversity and aesthetic values

➢ The socio-cultural dimension

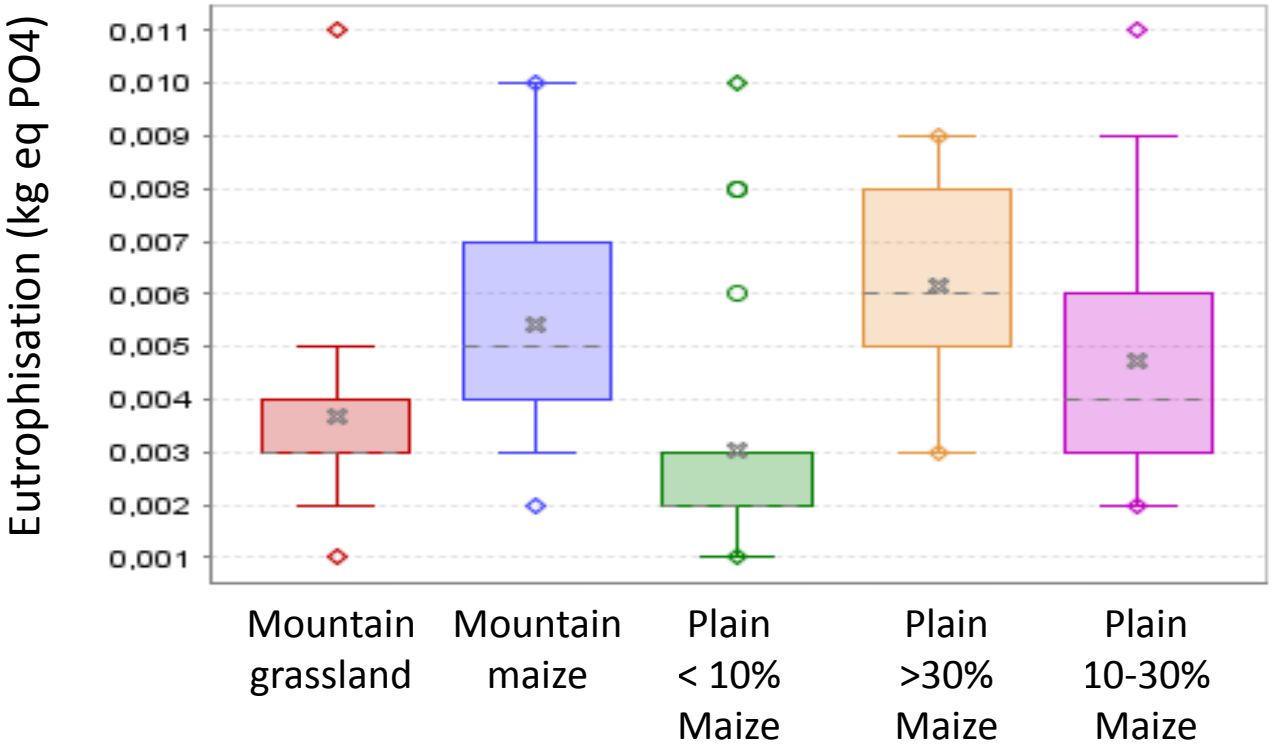
- Reduce workload and improve live quality of farmers
- Minimize competition with human food (use of crops and lands) – human edible returns
- Produce animal products that are safe and affordable to consumers
- Respect perception, belief and cultural values of the societies

Towards more responsible animal production systems

Some rooms to manoeuvre exist for increasing performances of animal production systems

➢ Survey of french dairy farms

- **Very large variability between farm for a given system**



(Dollé et al., 2013)

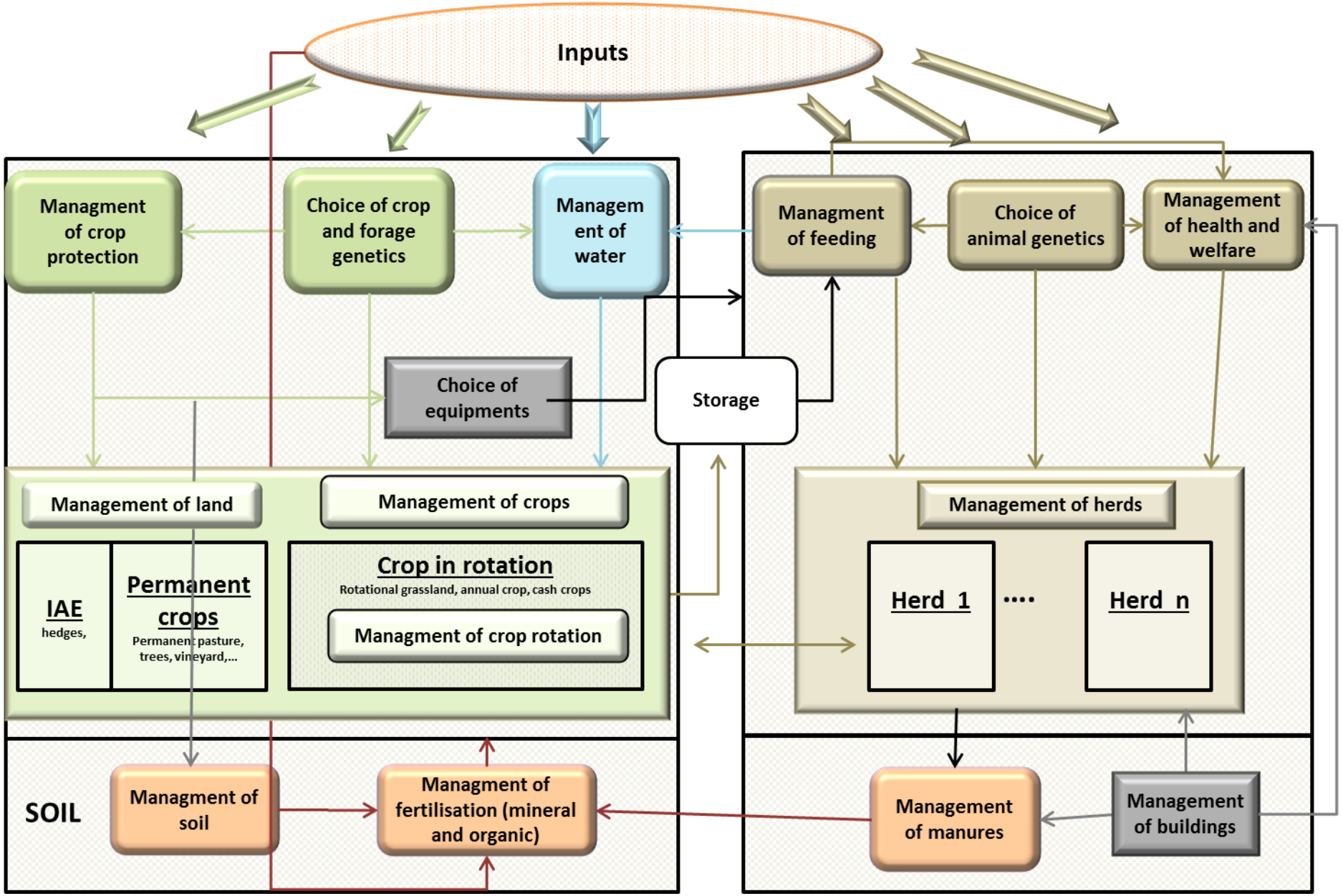
Developped approach

Inventory of the farm performances (n = 35)

- Production (quantity and quality)
- Economy (10)
- Utilisation of no (low) renewable resources (4)
- Environment (soil, water, air, biodiversity : 16)
- Social (animal welfare, work : 3)

Generic representation of the farm management

- Identification of 15 classes of practices : choice of animal genetics, animal feeding, management of manure, fertilisation, management of soil, of crop …
- 203 elementary practices


Inputs
Managment of crop protection
Choice of crop and forage genetics
Managem ent of water
Managment of feeding
Choice of animal genetics
Management of health and welfare
Choice of equipments
Storage
Management of land
Management of crops
IAE
hedges,
Permanent crops
Permanent pasture, trees, vineyard,...
Crop in rotation
Rotational grassland, annual crop, cash crops
Managment of crop rotation
Management of herds
Herd 1
....
Herd n
SOIL
Managment of soil
Managment of fertilisation (mineral and organic)
Management of manures
Management of buildings

Developped approach

➢ Inventory of the farm performances (n = 35)

- Production (quantity and quality)
- Economy (10)
- Utilisation of no (low) renewable resources (4)
- Environment (soil, water, air, biodiversity : 16)
- Social (animal welfare, work : 3)

➢ Generic representation of the farm management

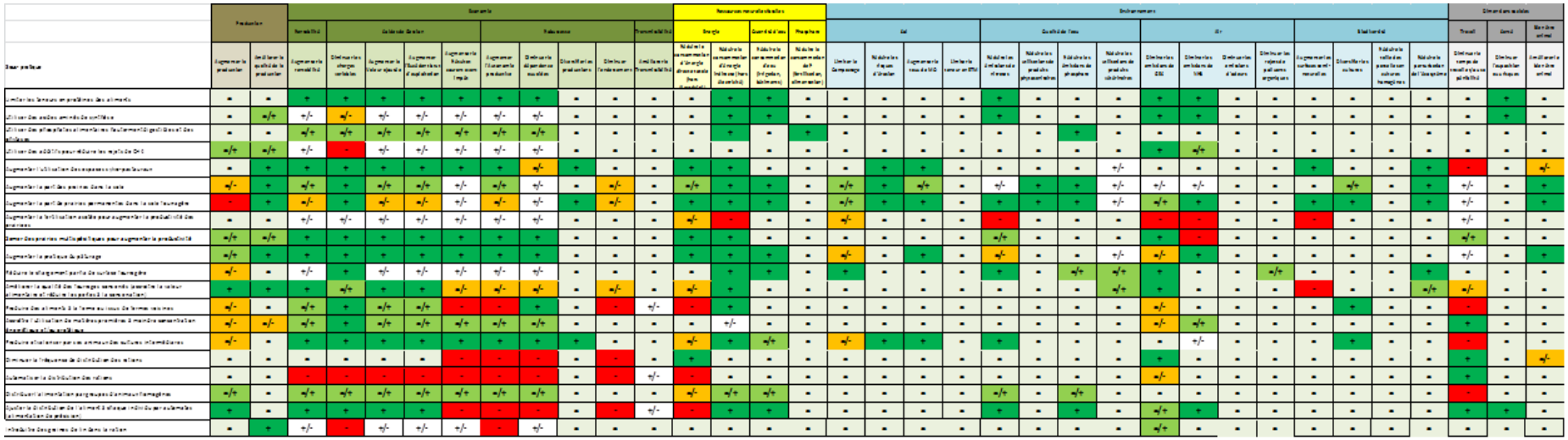
- Identification of 15 classes of practices : animal genetics, animal nutrition, manure management, fertilisation, soil management, crop management …
- 203 elementary practices

➢ Qualitative evaluation of the impacts of the elementary practices

- Production of a matrix : 203 practices x 35 performances **: +, =/+, =, =/-, -, +/-**

Qualitative evaluation of the impacts of the elementary practices

Production Economy Resource Environment Social



Energy Water P Soil Water Air Biodiversity

Developped approach

Inventory of the farm performances (n = 35)

- Production (quantity and quality)
- Economy (10)
- Utilisation of no (low) renewable resources (4)
- Environment (soil, water, air, biodiversity : 16)
- Social (animal welfare, work : 3)

Generic representation of the farm management

- Identification of 15 classes of practices : animal genetics, animal nutrition, manure management, fertilisation, soil management, crop management …
- 203 elementary practices

Qualitative evaluation of the impacts of the elementary practices

- Production of a matrix : 203 practices x 35 performances **: +, =/+, =, =/-, -, +/-**

Evaluation of the compatibility between practices

- 1: great interest to be used together, 0: independent, -1: incompatible

Development of a tool for the conception of innovative systems

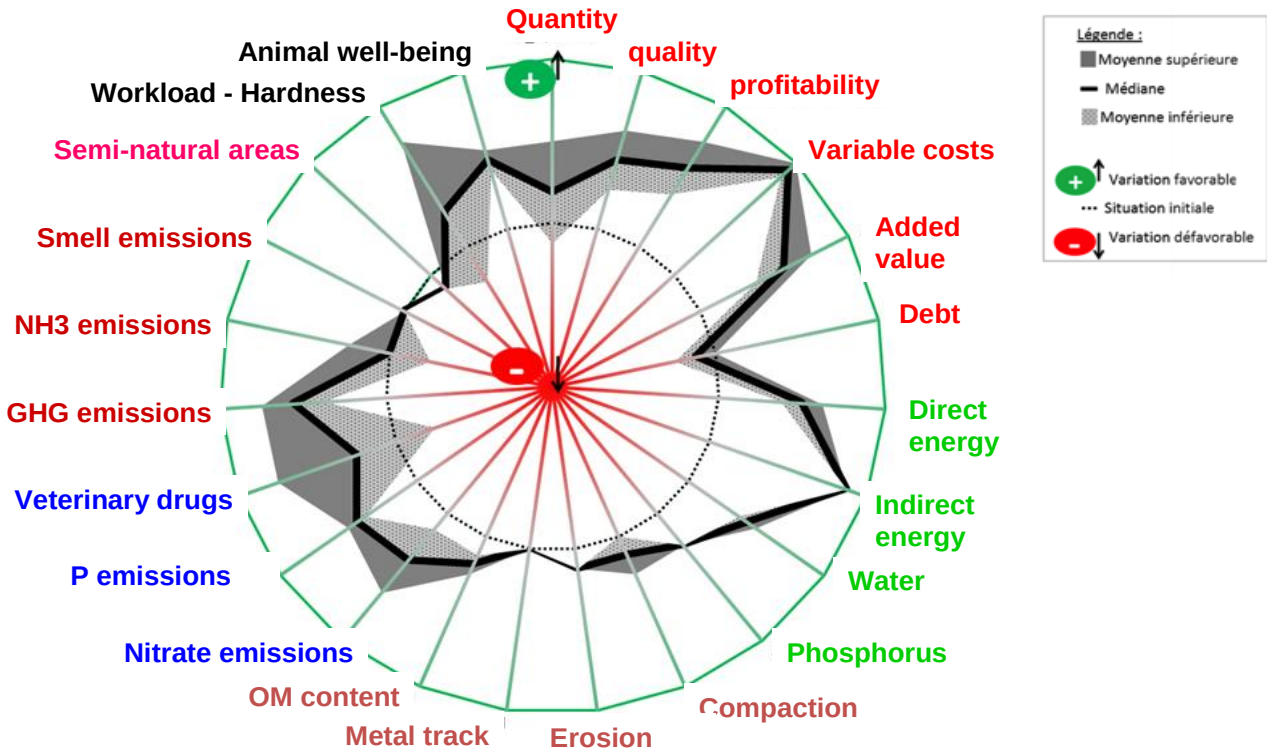
- From aggregation of practices
- Starting point : existing system, a given key practice, some desired performances

Grassland based dairy System (in plain)
Specification “low inputs Innovative foraging systems”

- **Choice of Animal genetic**
  - *Select bulls to increase the robustness of the cows*
- **Feeding strategy**
  - *Increase the proportion of grassland area in the total agricultural area of the farm*
  - *Decrease the proportion of annual crop in the total agricultural area of the farm*
  - *Decrease the stocking rate*
  - *Introduce multispecies swards (mixtures of grasses and legumes) to increase yield*
  - *Increase the proportion of grazing*
  - *Increase the nutritional quality of conserved forages*
- **Herd management**
  - *Increase the number of lactation achieved per cows (4 lactations instead of three)*

Objectives *:*

- *To enter into the specification « Low inputs Innovative Foraging Systems »*
- *To increase the productivity of this grassland based dairy system*



Difficulties

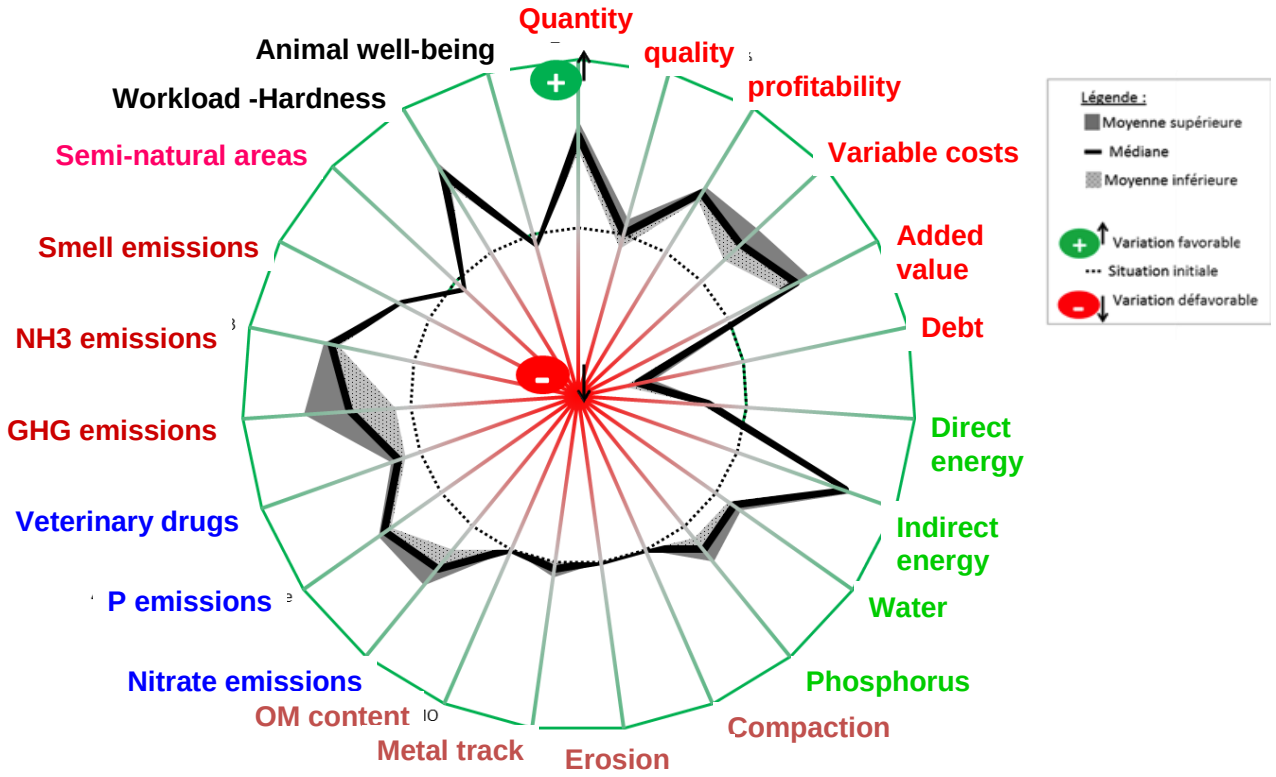
- ✓*High price of cereals and reduction of the availability of straw for the litters*
- ✓*Acceptability of grassland based systems / variation of production according to the meteorology)*

Innovative intensive dairy System (in plain)

- **Management of building and choice of equipments**
  - *Install a milking robot*
  - *Use sensor-driven technology for precision livestock farming*
  - *Use automatic device for forage distribution*
- **Management of manure**
  - *Use devices for local manure application*
  - *Cover manure pits*
- **Mineral and Organic fertilisation**
  - *Use DSS for N, P and K fertilisation*
- **Management of animal feeding**
  - *To improve the nutritional quality of forages*
  - *To adjust precisely feed supply to animal demand*
- **Management of genetic resources**
  - *Choose genetics for improving the productive performances*
- **Management of livestock**
  - *Improve heat detection*

Objectives *:*

- *To reduce work load using milking robots and others automatisms*
- *To improve herd and manure management to reduce variable cost and reduce harmful emissions*



Difficulties

- ✓ *Huge investments and uncertainties for economic results (even if they appear positive in the qualitative analysis)*
- ✓ *Increased dependency to fossil energy*

Conclusion

Multi performing animal production systems

- **The study show that it is possible to make progress in the short term**
  - both on production and environment performances simultaneously

- **The solutions cause some problems**
  - Investment - workload - productivity

- **Hopefully we can do better in the future**
  - Research priorities

Research and innovation to tackle the challenges

➢ More responsible livestock farming systems

- Increased efficiency of production while maintaining (increasing) productivity
  - Efficient and robust animals,
  - Herd management
  - Feeding strategy : full use of feed material having no alternative value (forages, by-products, wastes)
- Increased protein and energy autonomy: legumes, farm and food chain organisation
- Precision livestock farming : management of health and ration formulation from individual animal information
- Improved grassland based systems : trade off between productivity / environmental services
- Climate smart livestock systems : mitigation of GHG emission, adaptation to climate change
- Enhanced diseases-tolerance and resistance, animal welfare
- Evaluation of performance ; eco-conception of innovative systems

➢ How to promote evolutions

- Public policies
- Stakeholder organisation: food chains and territories

based on the recent white paper of the Animal Task Force

Thank you for your attention