

# Impacts of climate change on the production of crops used in French livestock systems

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# Introduction

Aim of the project : assess the possible effects of climate change on the main livestock systems in France

Method : using climate projections of GCM to calculate agroclimatic indices or as inputs of a crop model

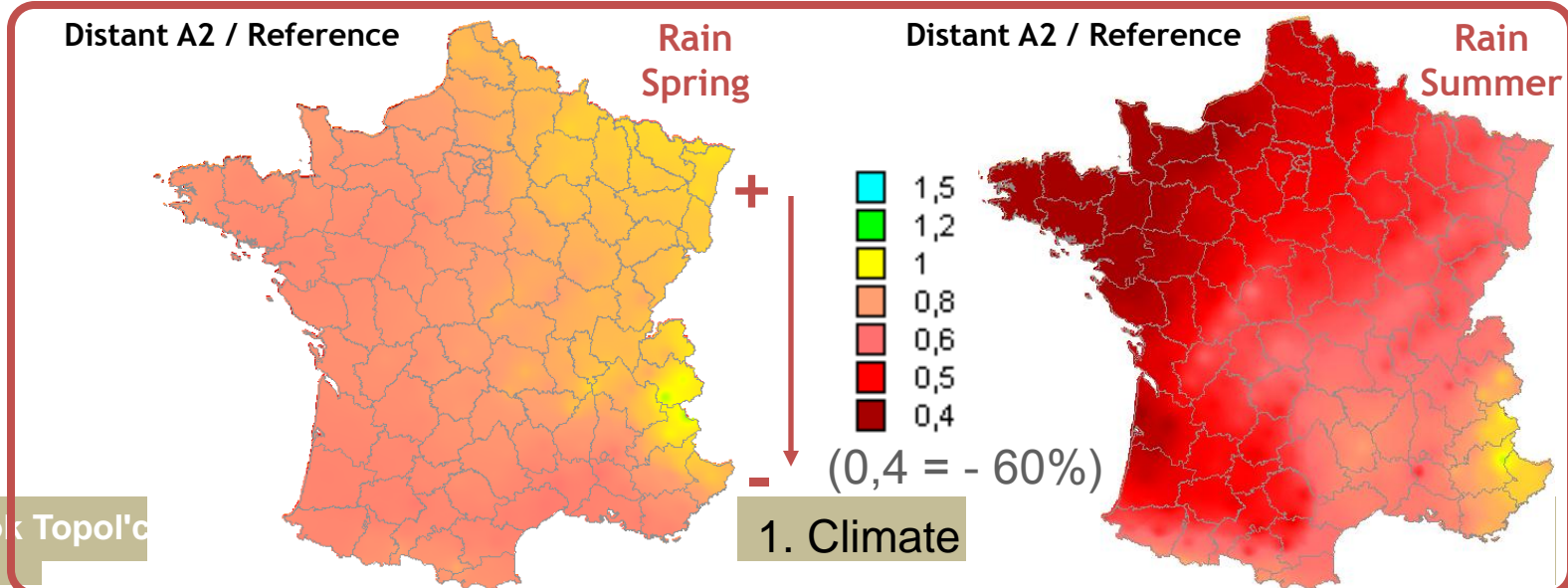
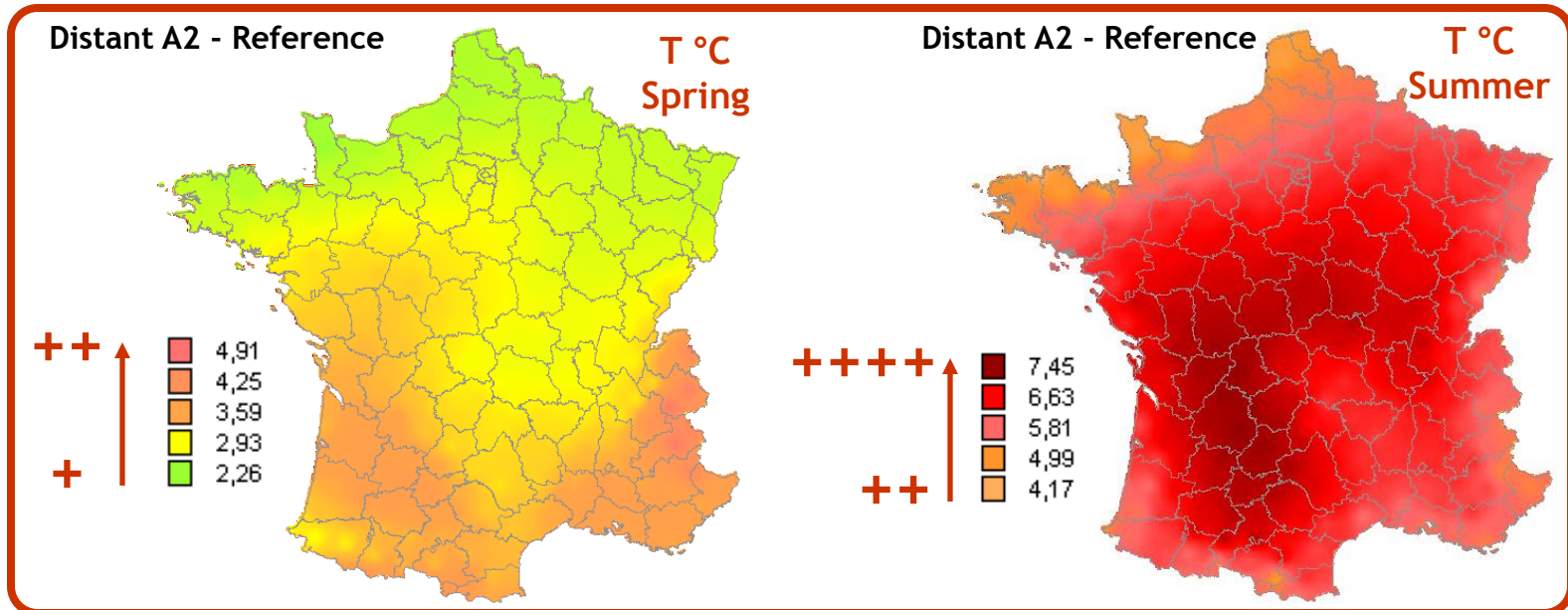
Aim of this talk : present some of the results of this project

temporal and spatial distribution of main climate changes in France,  
some agroclimatic indices,  
effects of climate change mainly on forage crops,  
show some examples of system adaptation.

# Climate

# Temperatures and rain changes

Scenario A2 , distant futur (2070-2099)



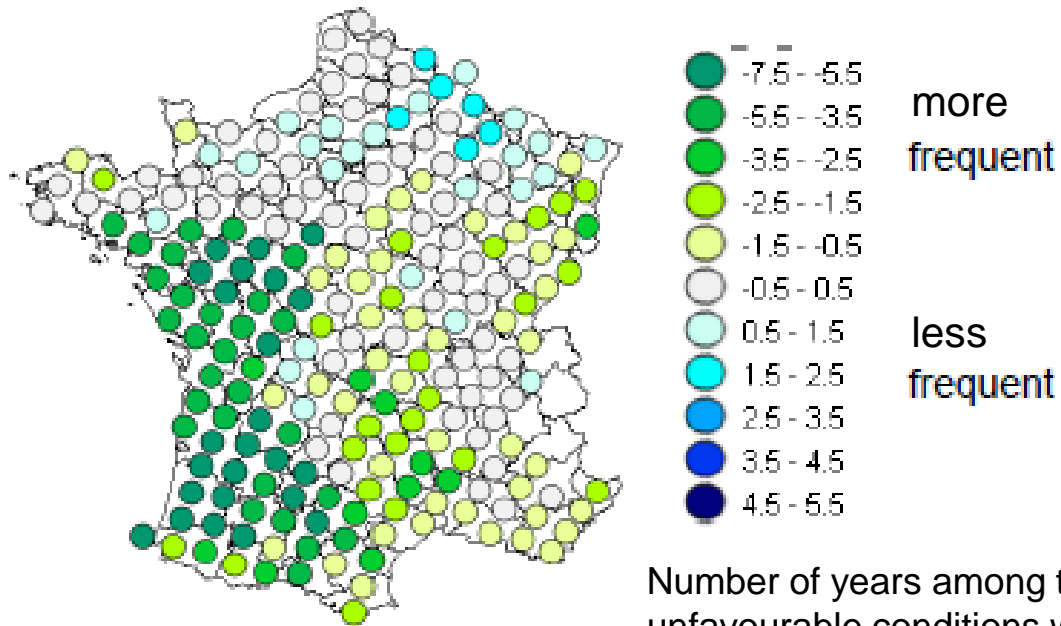
Data from CNRM  
Météo-France  
ACTA CC Project of Topol'c

# Climatic indicators

# Indicators

- dates of practices defined according to the zones (MFA)
- criteria defined for each season
  - first grazing date: several days without rain (favourable) or high rain (saturated soil, un favourable)
  - production : too high temperatures, low or very high rainfall
  - hay harvest: several consecutive days without rain for drying
- criteria calculation and mapping

# Soil trafficability for early grazing



Number of years among ten when more or less unfavourable conditions will occur in the distant A2 scenario

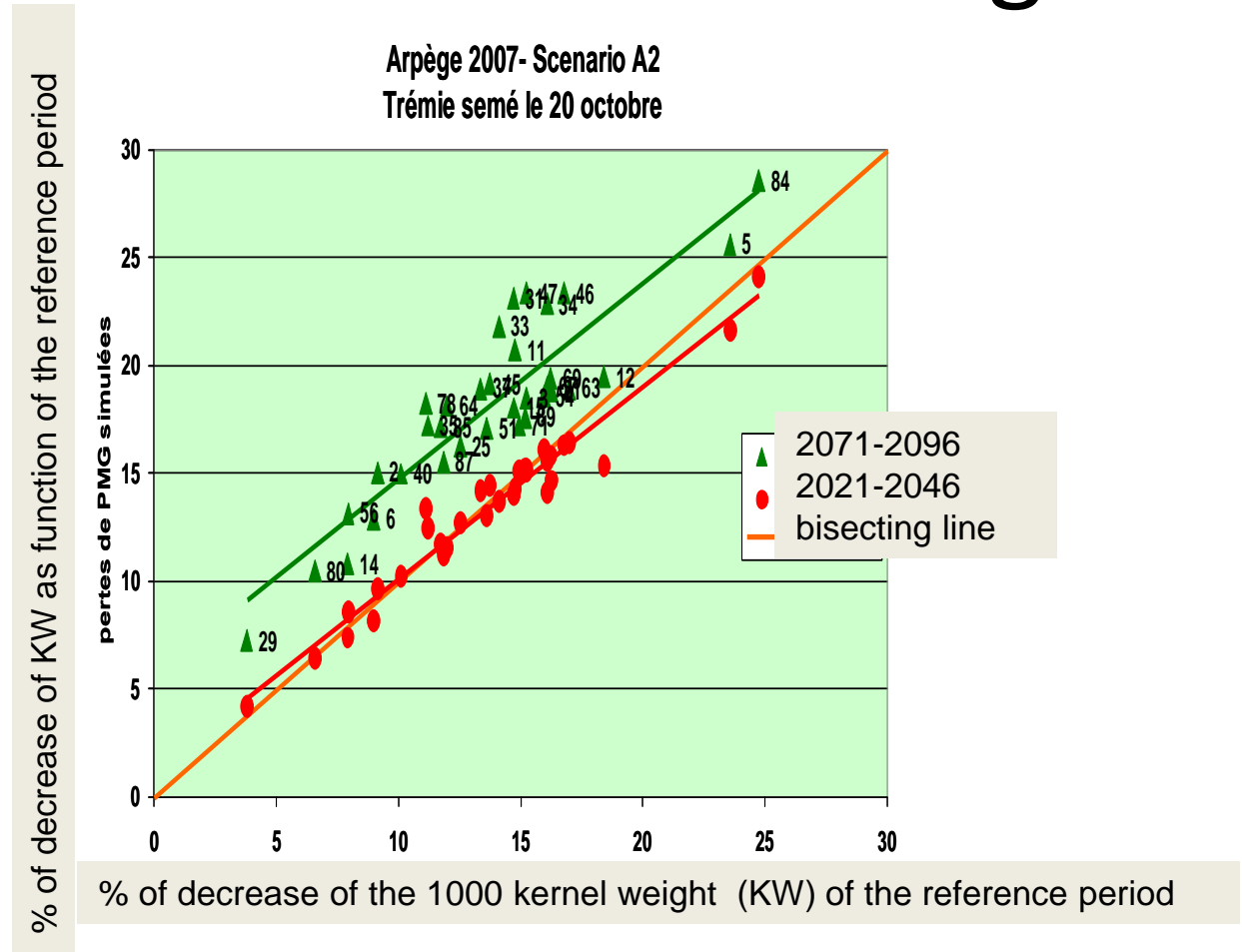
Agro-climatic indicator for the soil trafficability for early grazing is the occurrence of a period of 5 days with rainfall higher than 60 mm occurs at the beginning of spring (500 °C. d after 1st feb.)

We compare the number of years with this occurrence in each temporal period

# Wheat : increase of shrivelling

Loss of yield  
(model Panoramix)

in the near future (red)  
in the distant future (green)



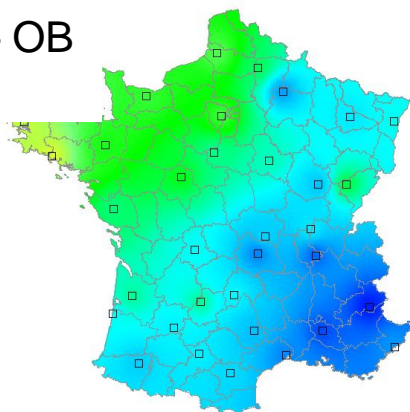
More days with high temperatures during grain filling → shrivelling → worse grain filling



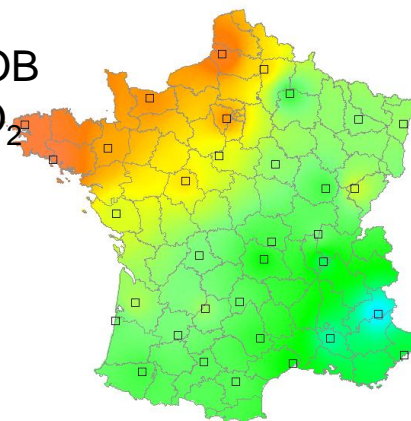
Crops: grass, alfalfa, maize

# Short or long term and CO<sub>2</sub> effects

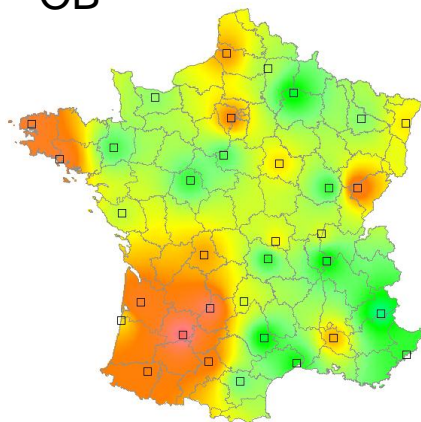
near A2 – OB  
with CO<sub>2</sub>



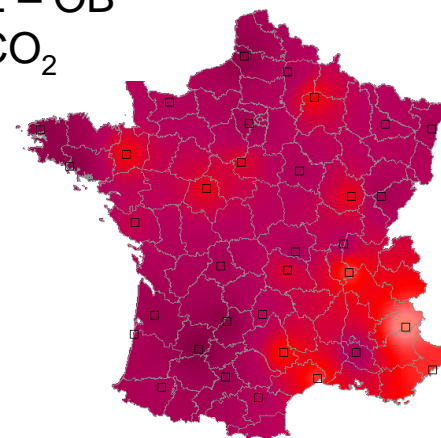
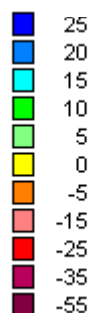
near A2 – OB  
without CO<sub>2</sub>



distant A2 – OB  
with CO<sub>2</sub>

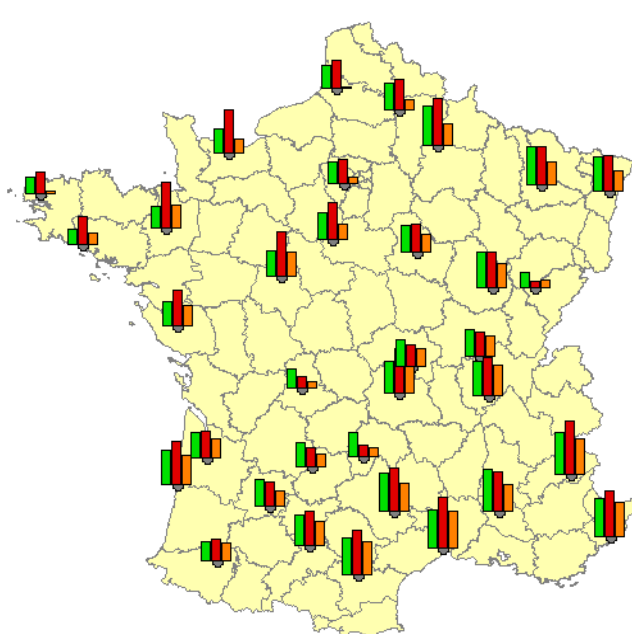


distant A2 – OB  
without CO<sub>2</sub>



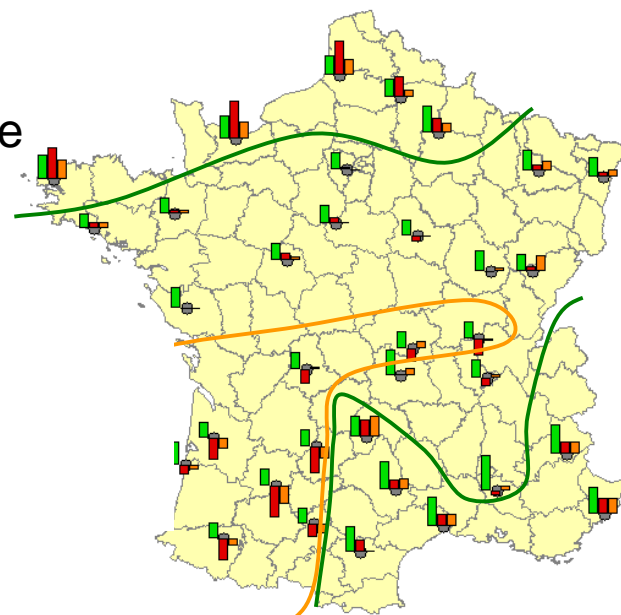
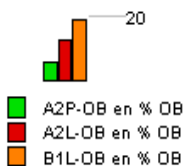
Ratio between the difference future-present and the present yield of grass  
OB= observed=reference, soil with low water reserve (66 mm), mowing (spaced out cuttings)

# Annual production for alfalfa and grass



Alfalfa

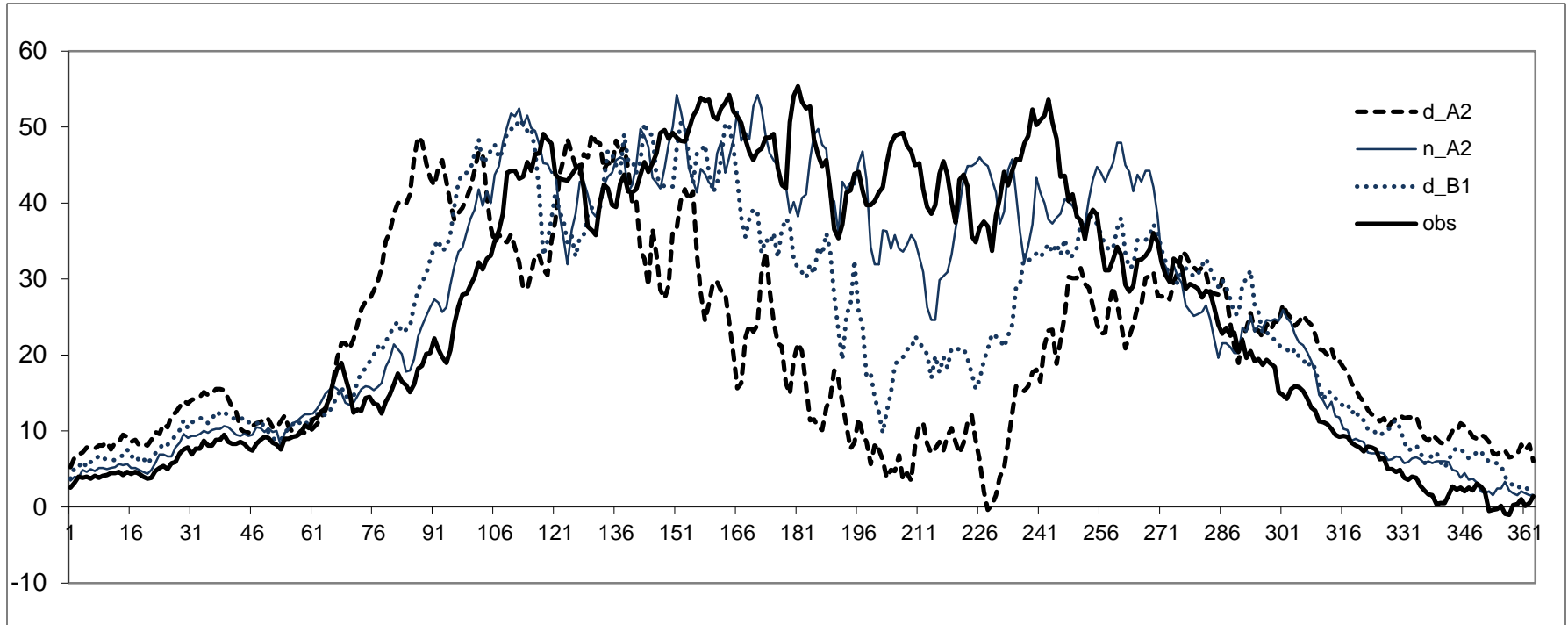
near A2, green  
distant A2 red  
distant B1 orange



Grass

Ratio between the difference future - present and the present production for 34 actual and fictive stations

# Changes of seasonal daily production



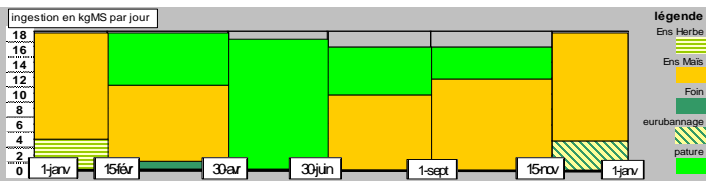
Aurillac (Lon 02° 26', lat 44° 55', altitude 639 m, Massif Central)

Daily dry matter production ( $\text{kg}\cdot\text{ha}^{-1}\cdot\text{day}^{-1}$ ), in the western slope of Massif Central

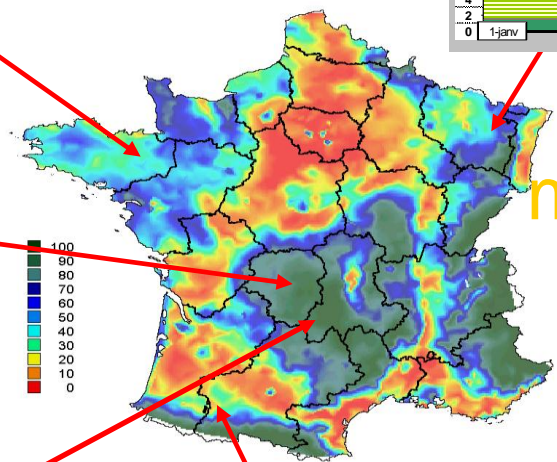
# Livestock systems

# Some french dairy and meat systems

## intensive and economical dairy system

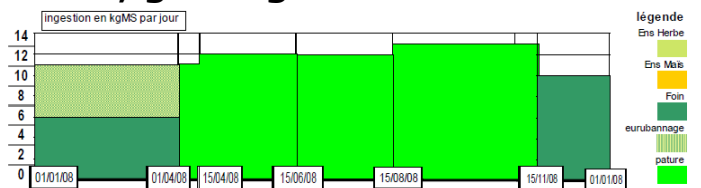


## meat and milk, maximum grazing

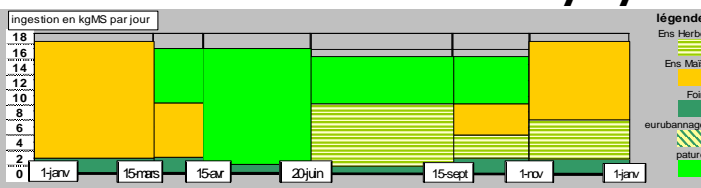


grazing  
grass silage

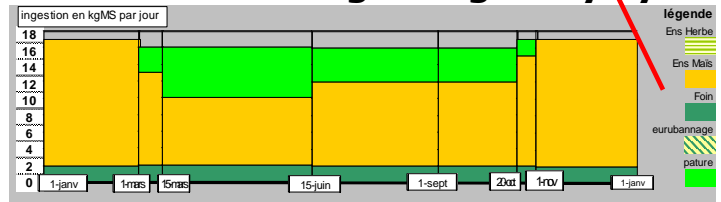
## meat, grazing



## semi-intensive mixed dairy system

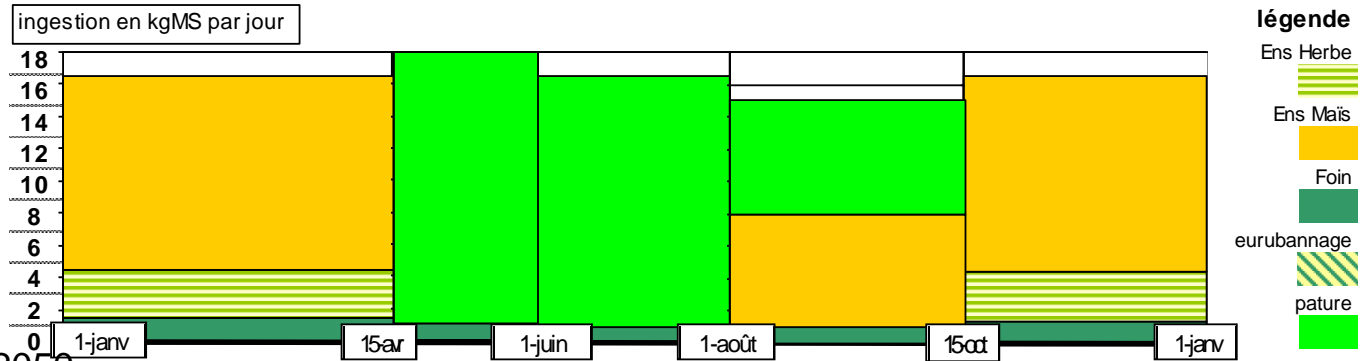


## maize and zero grazing dairy system

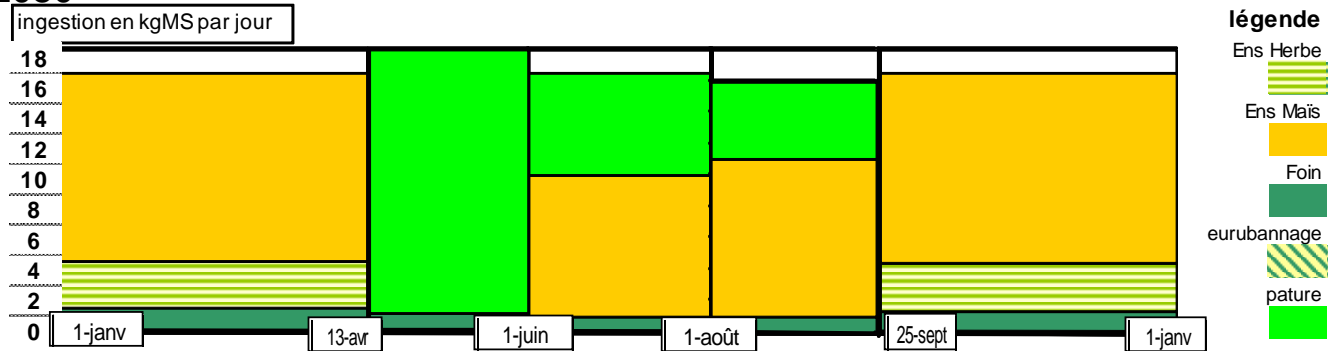


# Dairy cows in Lorraine (NE)

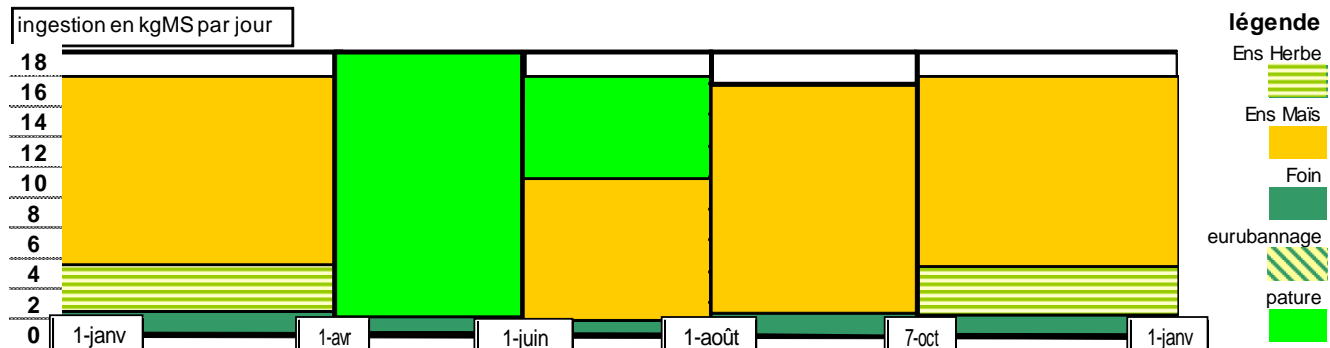
Nancy : present (and recent past) 1980-2006



Near future : 2020-2050



Distant future 2070-2099



# Conclusion

Most important results :

changes of dates : all is earlier (more sure because processes involved are well known)

changes in production seem to be low in the near future and high in the distant future, especially in the "pessimistic" scenario, which seems to be near from reality. In the distant future, they depend more on the effect of CO<sub>2</sub> which is in debate.

Moreover, the importance of the processes involved in stresses will take more importance : as the crops will take place in non optimal conditions, some processes like setting of roots and the volume where they can extract water or nutrients become more and more important, and the ability to understand and predict it will have more influence than now.



Thank you for your attention

