



1ST EUROPEAN SORGHUM CONGRESS

WORKSHOP

INNOVATIVE RESEARCH TOWARDS GENETIC PROGRESS

ESSENTIAL RESEARCH PRIORITIES

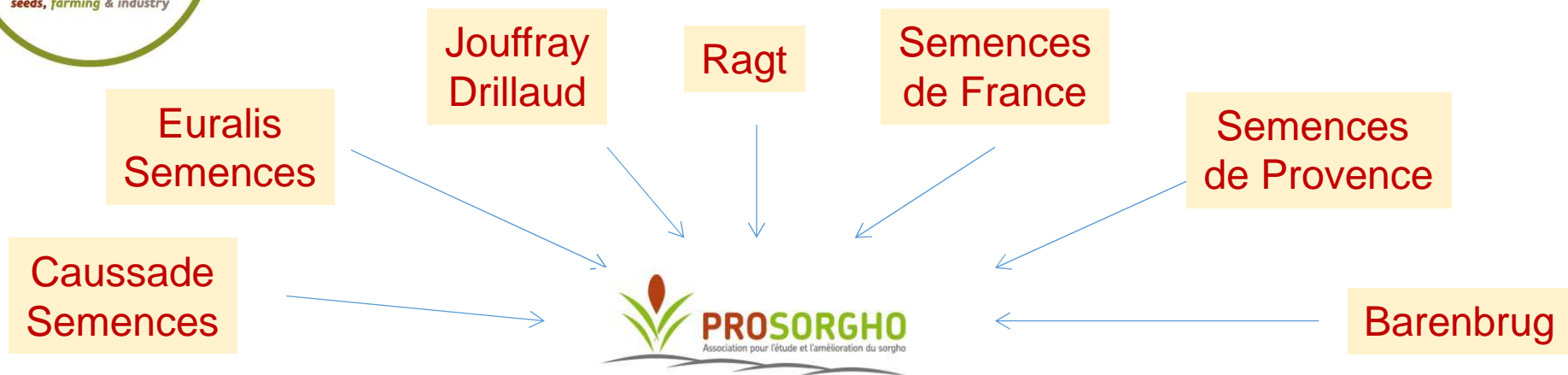


Patrice JEANSON, Sorghum breeder,
PROSORGHO / EUROSORGHO FRANCE

BUCHAREST
3-4 NOVEMBER 2016



PROSORGHO DESCRIPTION



A non-profit association with 7 seed companies involved in the breeding and / or sales of sorghum varieties.

Missions:

- Upstream: joint work on the genetic improvement of sorghum
- Development of partnerships with other stakeholders of the sorghum industry: ARVALIS, CIRAD, INRA.
- Downstream: promotional activities for the development of sorghum cultivation in France



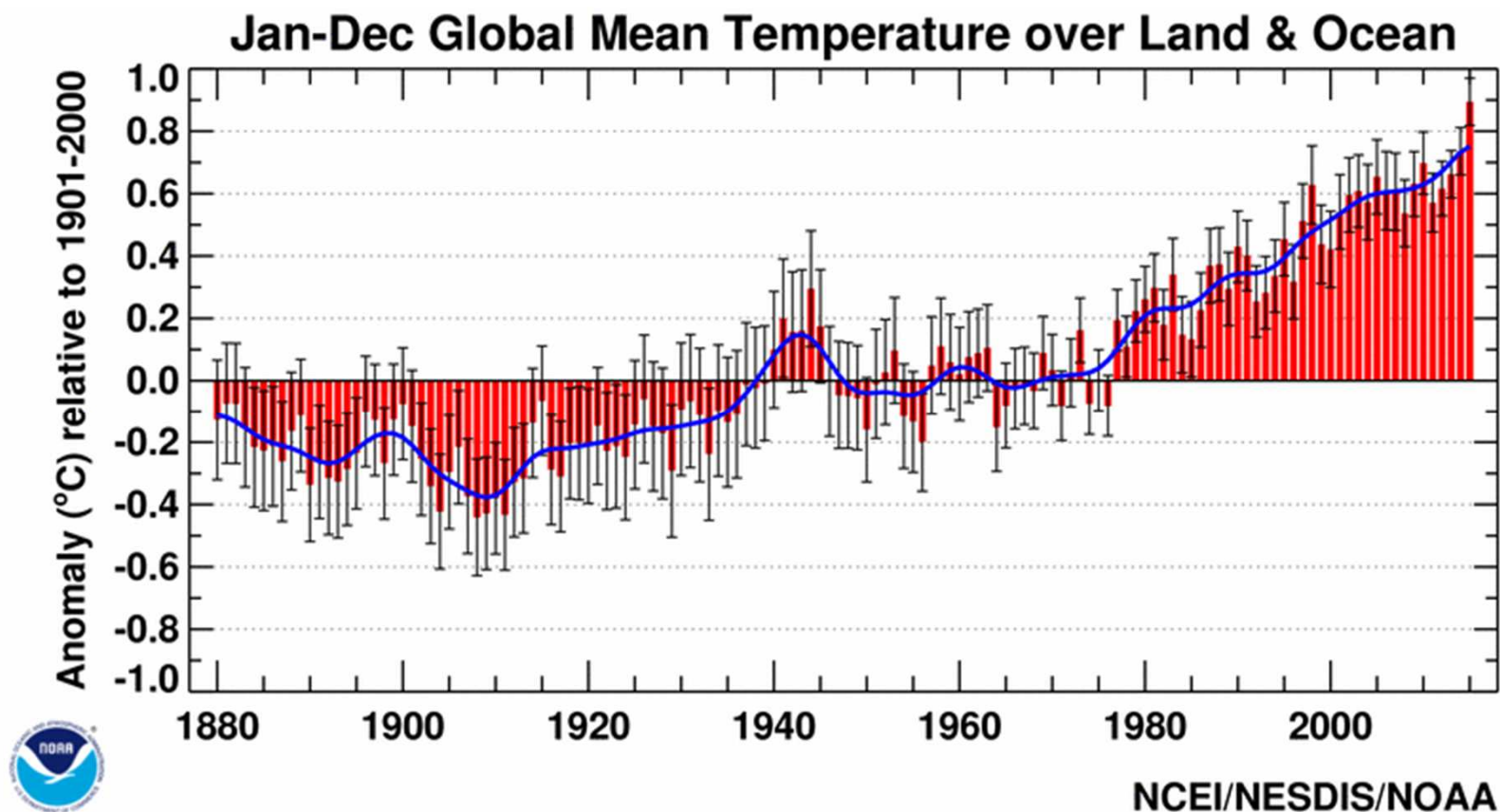
ESSENTIAL RESEARCH PRIORITIES

THE USUAL AXES OF BREEDING

- **Yield**
- **Earliness**
- **Quality: no tannin for grain**
- **Agronomic comportment**
- **Diseases**

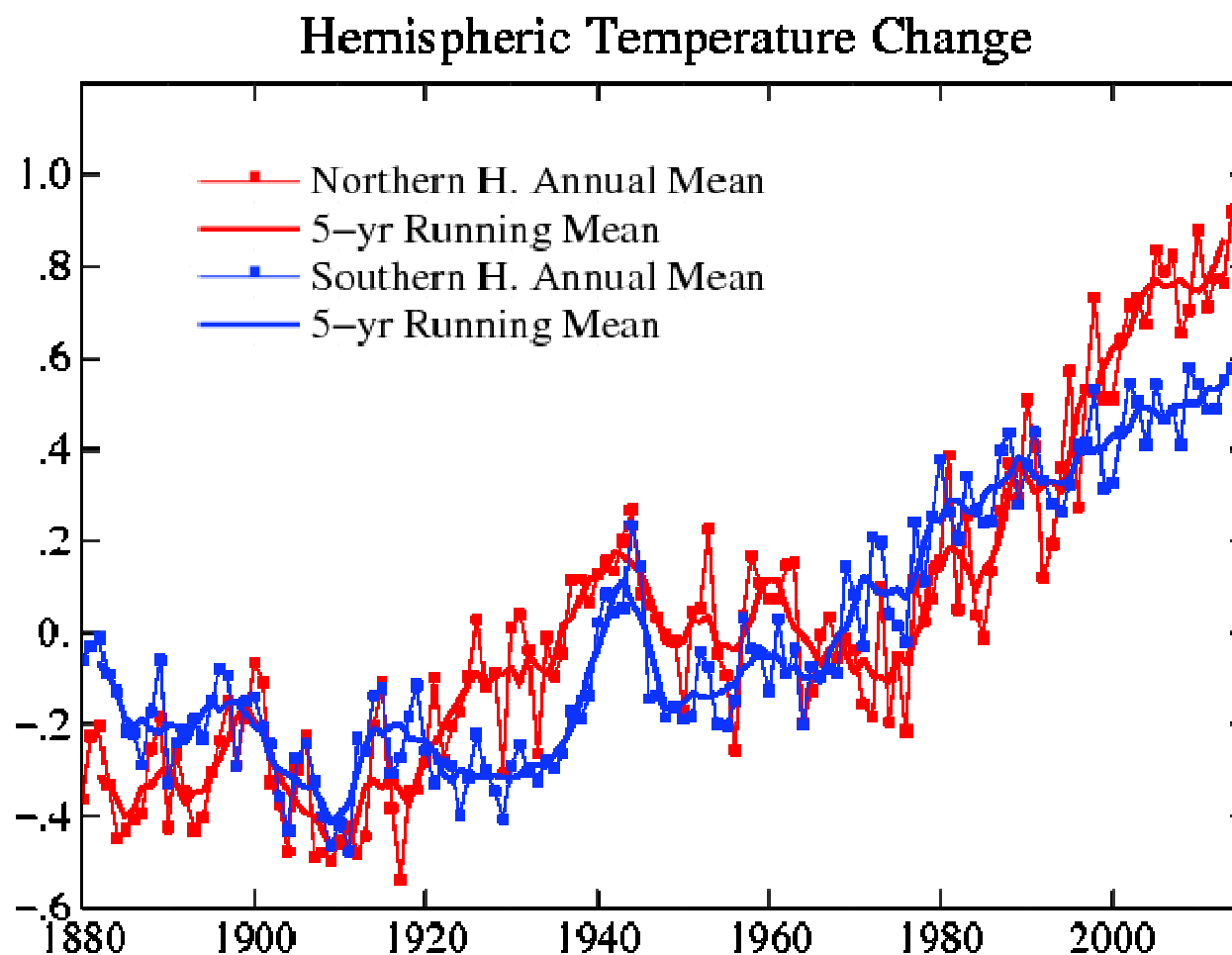
WHAT CHANGES?

THE CLIMATE CHANGE



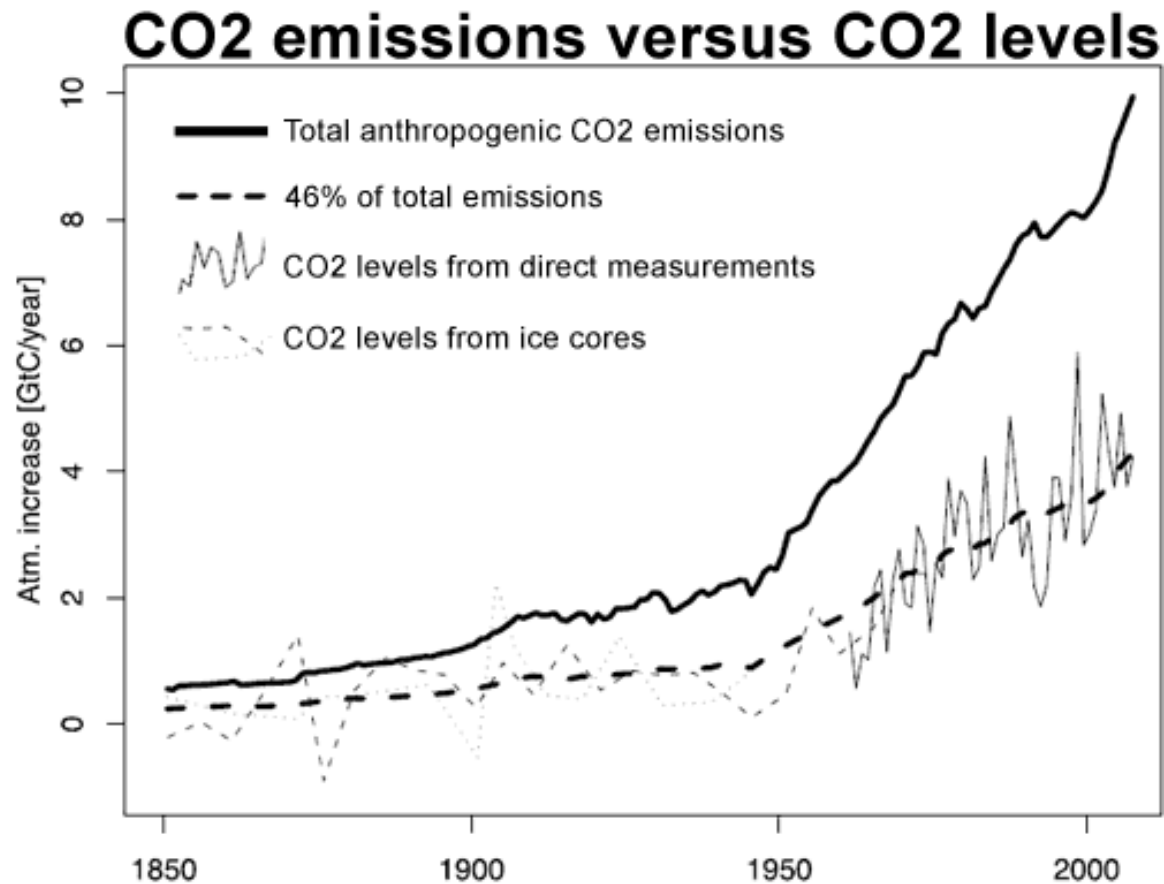
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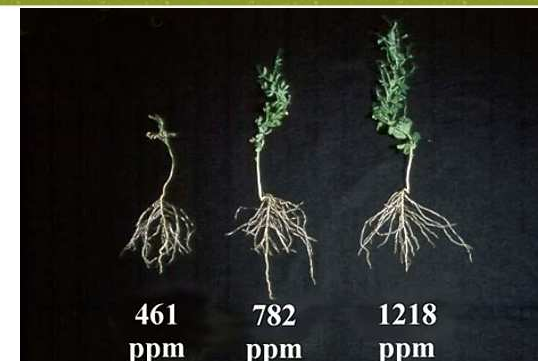
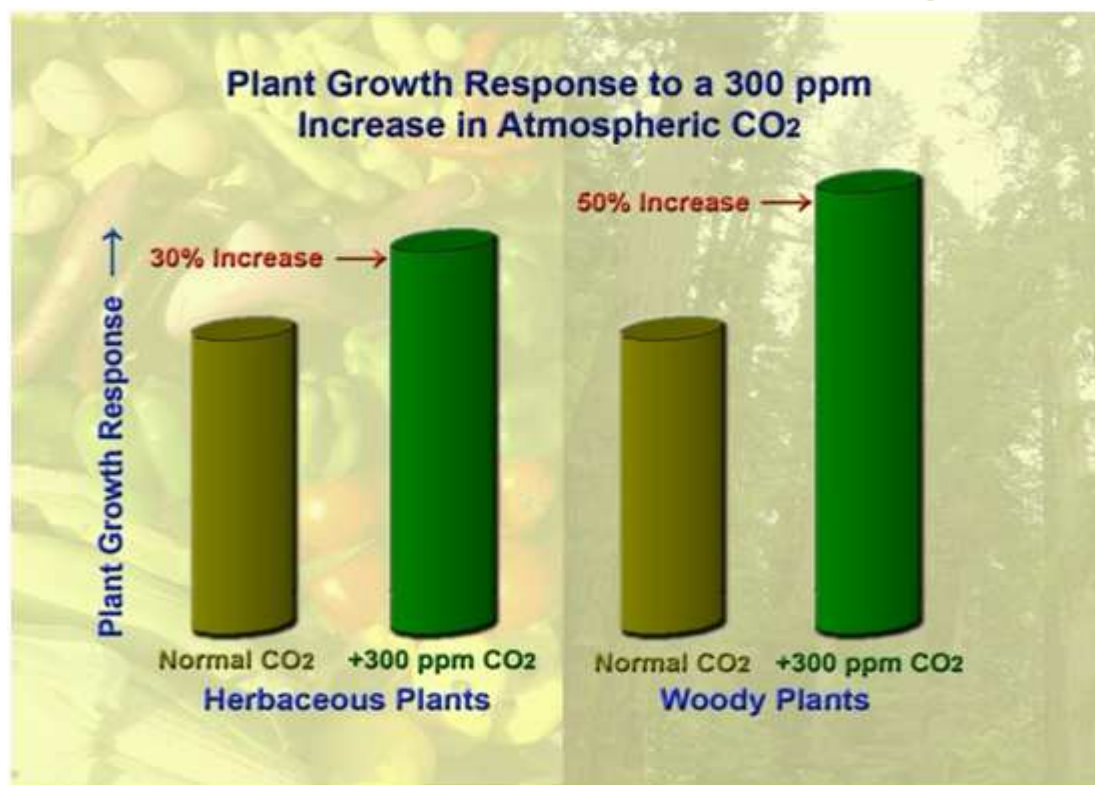
INCREASED CO2 LEVEL



INCREASED CO₂ LEVEL

IMPACTS ON PLANT GROWTH

Carbon dioxide: beneficial to plant growth



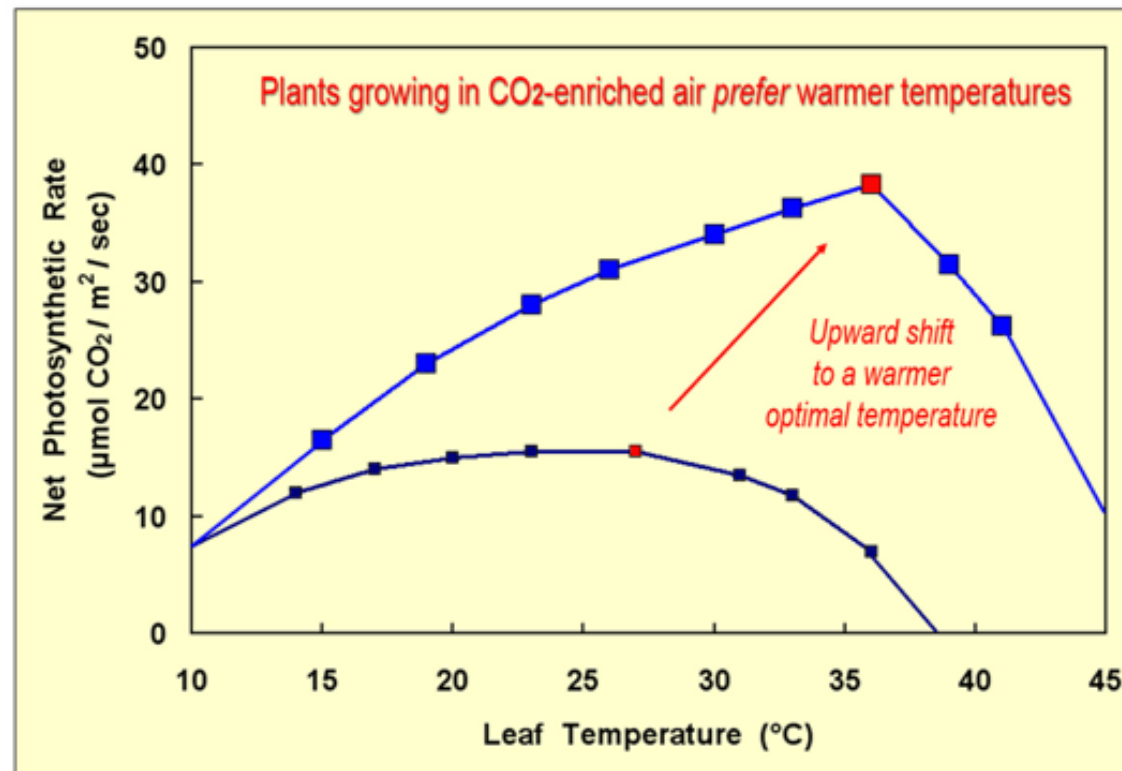
Mean % yield increases produced by a 300 ppm increase in atmospheric CO₂ concentration

C3 CEREALS 48,8%

C4 CEREALS 20 %

CARBON DIOXIDE AND TEMPERATURES

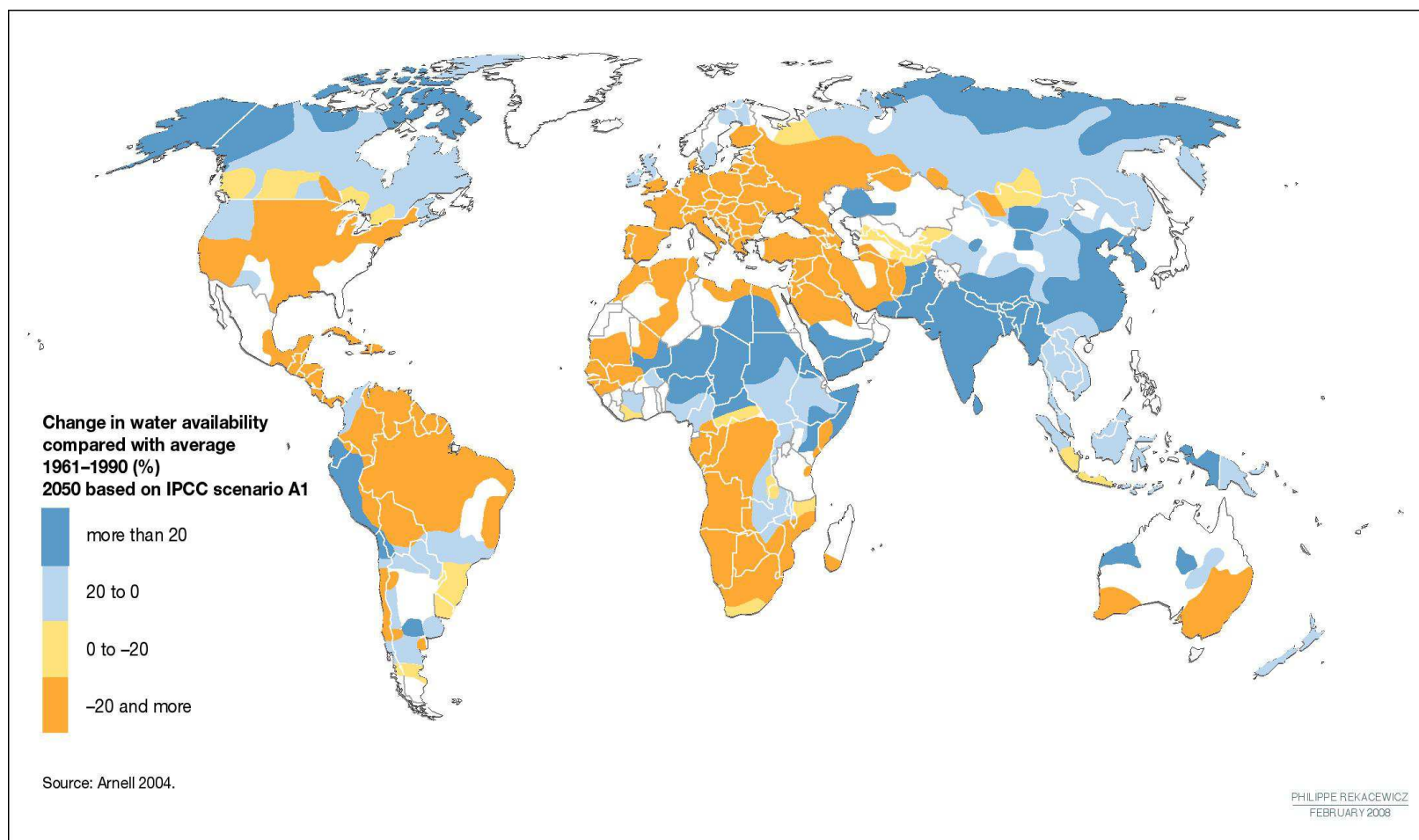
IMPACTS ON PLANTS GROWTH



➡ **Breeding for tolerance to high temperatures at flowering stage**

WHAT CHANGES?

WATER AVAILABILITY





ESSENTIAL RESEARCH PRIORITIES

BREEDING FOR DROUGHT STRESS

MAINS STRATEGIES

- **Avoidance strategy** —→ **Breeding and cultivating early varieties**
- **Early sowing** —→ **Drop the germination temperature threshold (12°C recommended currently to 9°C)**
—→ **Breeding for early vigor in the seedling stage**
- **Breeding for global comportment to drought**
 - Stay green
 - Stomatal regulation
 - Root development
 - Growth rate
 - Water efficiency



BREEDING FOR DROUGHT STRESS

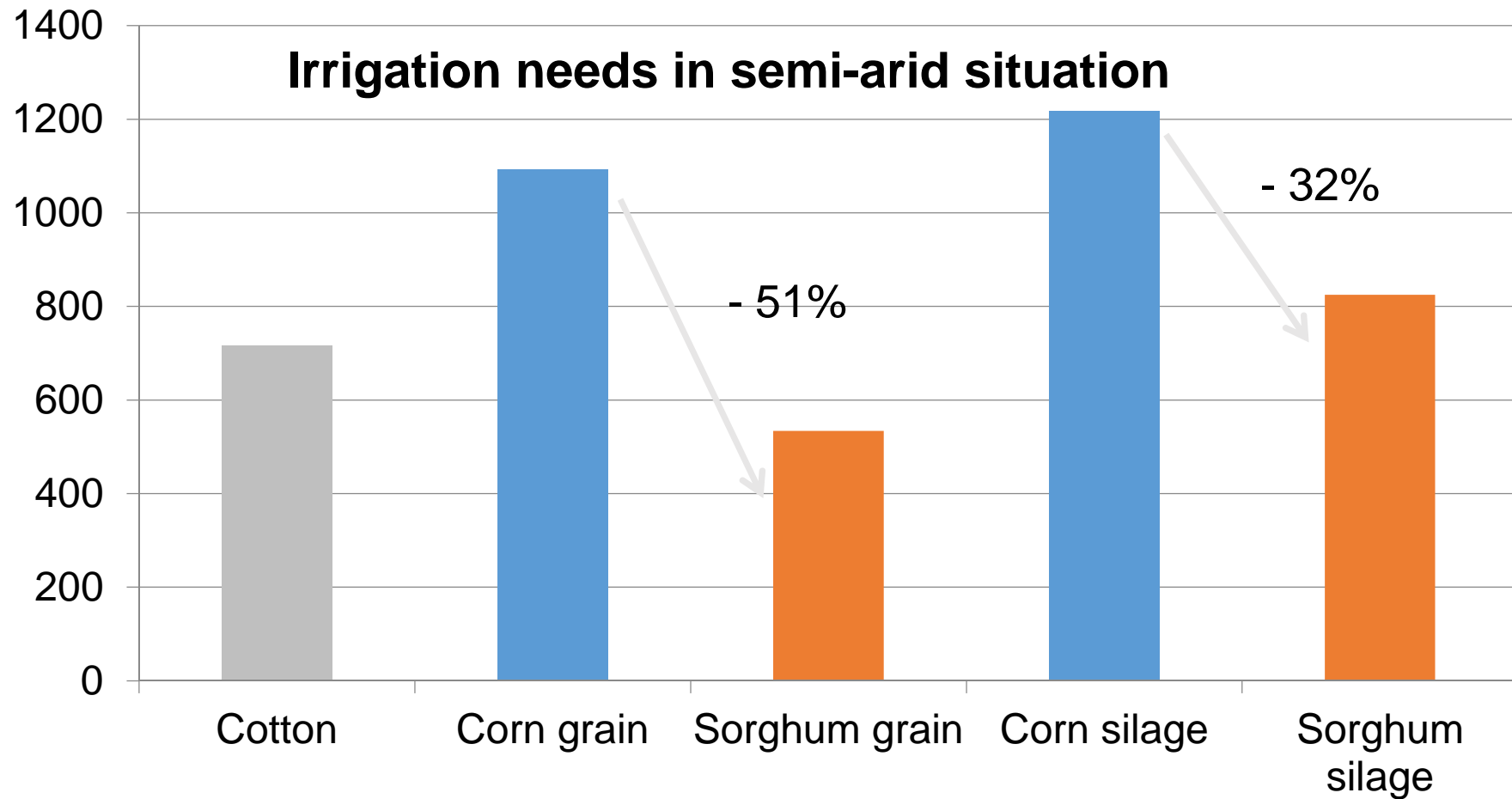
	Irrigated	Non irrigated
Corn		
Yield (t MS/ha)	24.8	9.0
Rainfall (mm)	610	330
Efficiency (kg MS/ha/mm)	40.6	27.4
Grain sorghum		
Yield (t MS/ha)	17.1	13.7
Rainfall (mm)	479	350
Efficiency (kg MS/ha/mm)	35.6	39.2

Table 1 : Compared efficiencies of water use by maize and by grain sorghum, with or without irrigation (Lemaire et al., 1991).



WATER NEEDS FOR SORGHUM VS CORN

(source tawc 2005-2010)



IMPACTS OF CLIMATE CHANGES

INCREASED PEST POPULATIONS

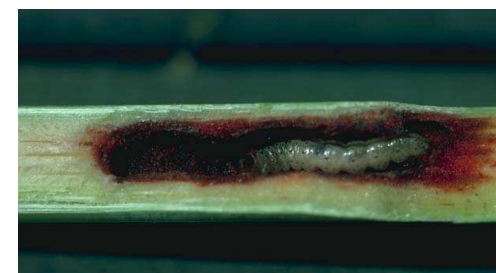
● **HELICOVERPA ARMIGERA**

- Damages on panicle,
- Eat the reproductive organs and the kernel at milk stage.



● **BORER**

- Eat the marrow of sorghum stalks especially sweet sorghum
- Kill the plants and increase lodging



IMPACTS OF CLIMATE CHANGE

INCREASED PEST POPULATIONS

APHIDS

Eat the phloem sap



Red and necrotic spots
on the leaves



General necrosis and
plant death

Sugarcane aphid



Yellow sugarcane aphid



Greenbug



Corn leaf aphid



➡ **Breeding for tolerant varieties, genetic could be a solution**



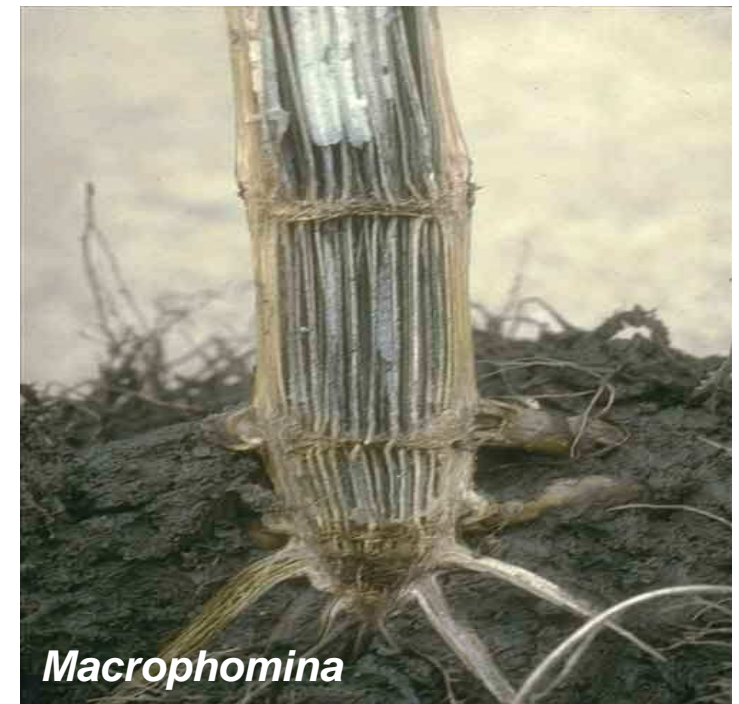
OTHER PESTS

FUSARIUM & MACROPHOMINA : *THE 2 MAIN DISEASES*

- **Attack at basis of stem (collar) and roots, important lodging observed with fast drying of the plant and the panicle**
- **Favorable factors: very hot temperature, very dry situation, high density of plants and high nitrogen level**
- **No specific genetic answer**

➔ **Breeding on global plant comportment in stress environment after flowering stage.**

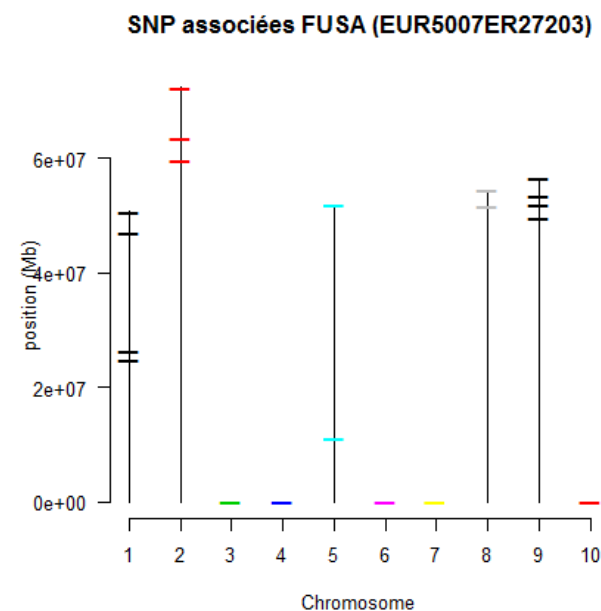
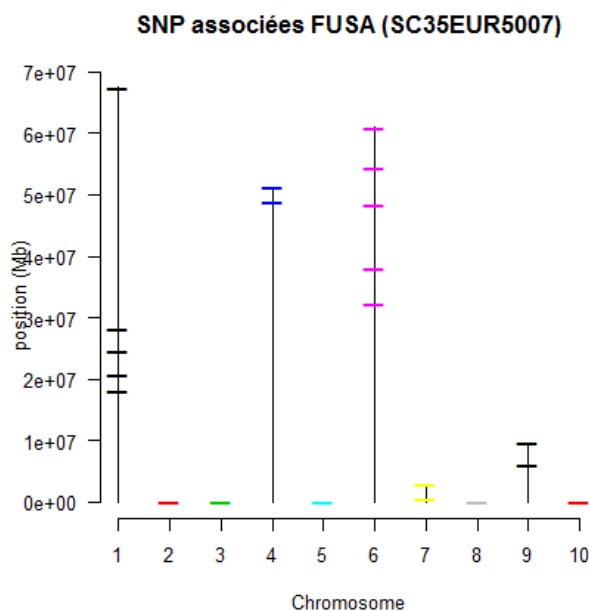
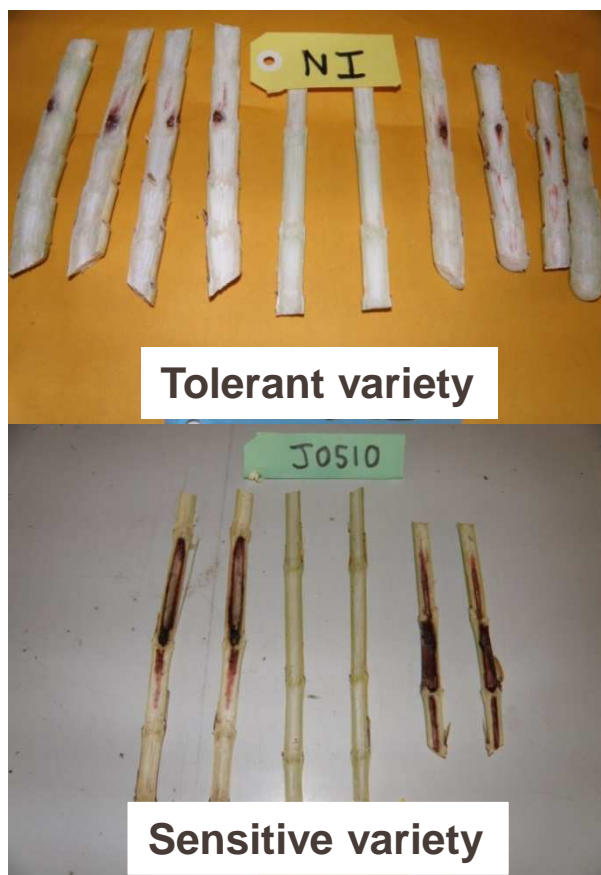
Genomic breeding



OTHER PESTS

FUSARIUM: USE OF MOLECULAR BREEDING

● Détection of QTLs for Fusarium resistance





NEW USES

HIGH DIGESTIBLE SORGHUM FOR SILAGE

Due to the climatic evolution sorghum can replace corn as silage for the animals

- HIGH GRAIN TYPE
- SWEET SORGHUM
- BMR SORGHUM:

Low lignin (BMR genes)

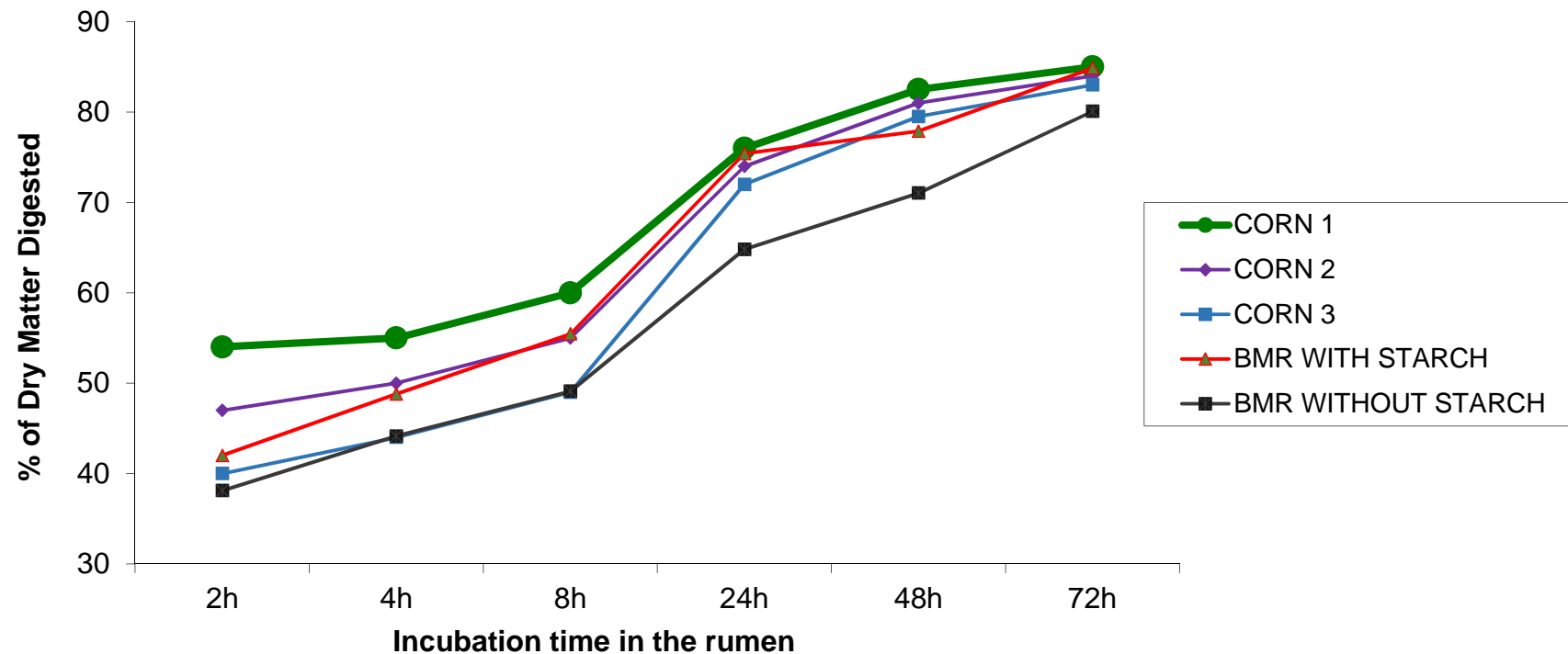
Very good digestibility, UFL between 0,9 to 1,1

Harvested at 30 to 35% of dry matter

Recommended for dairy farmers



HIGH DIGESTIBLE SORGHUM FOR SILAGE

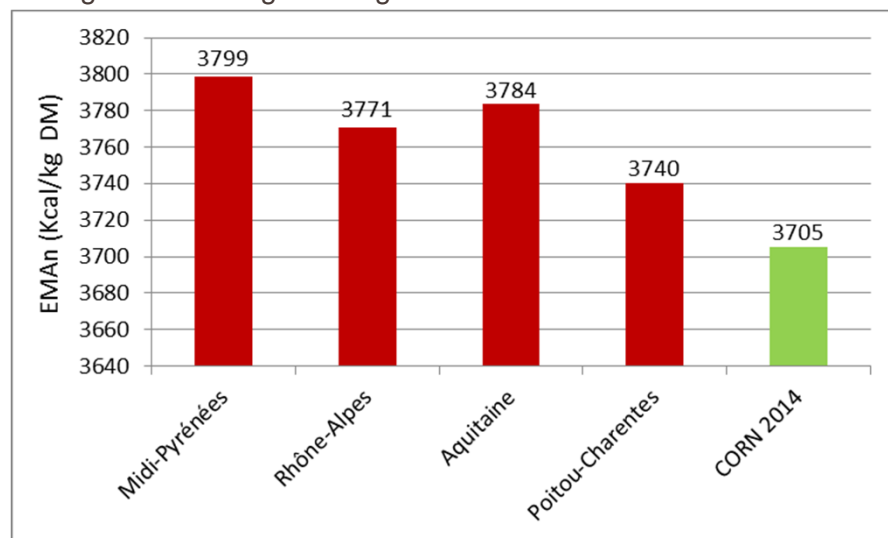


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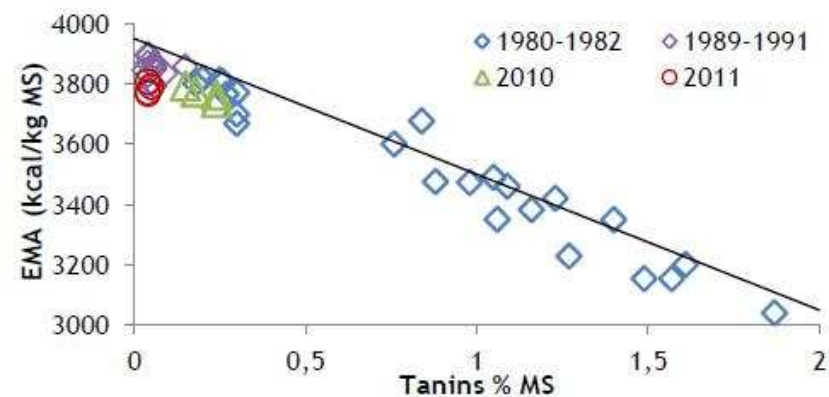
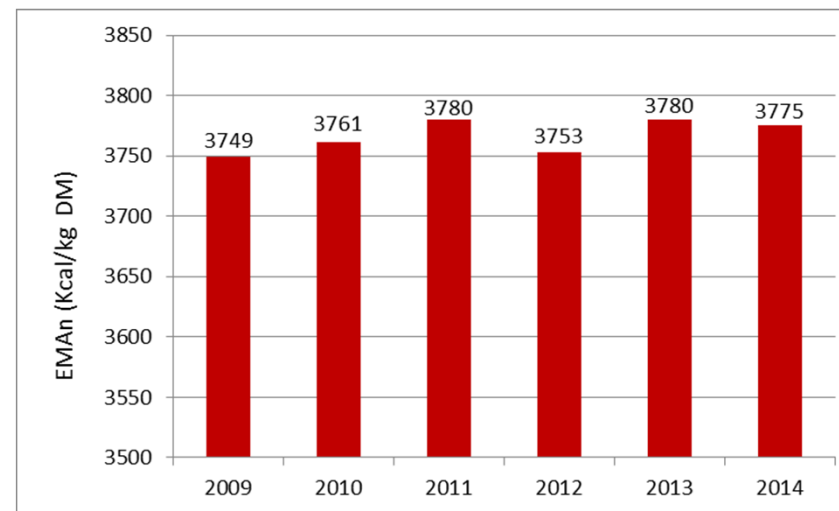
HUMAN FOOD

- **Gluten free cereal with good nutrition value**

Energetic value of grain sorghum in France 2014



Evolution of energetic value between 2009 to 2014



Necessity of very low tannin varieties



THANK YOU FOR YOUR ATTENTION



Euralis platform 2015

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