



Regional estimation of diffuse pollution with the Soil and Land Resources Information System (SLISYS)

A.M. IGUE, T. GAISER, H. WEIPPERT and K.STAHR

University of Hohenheim



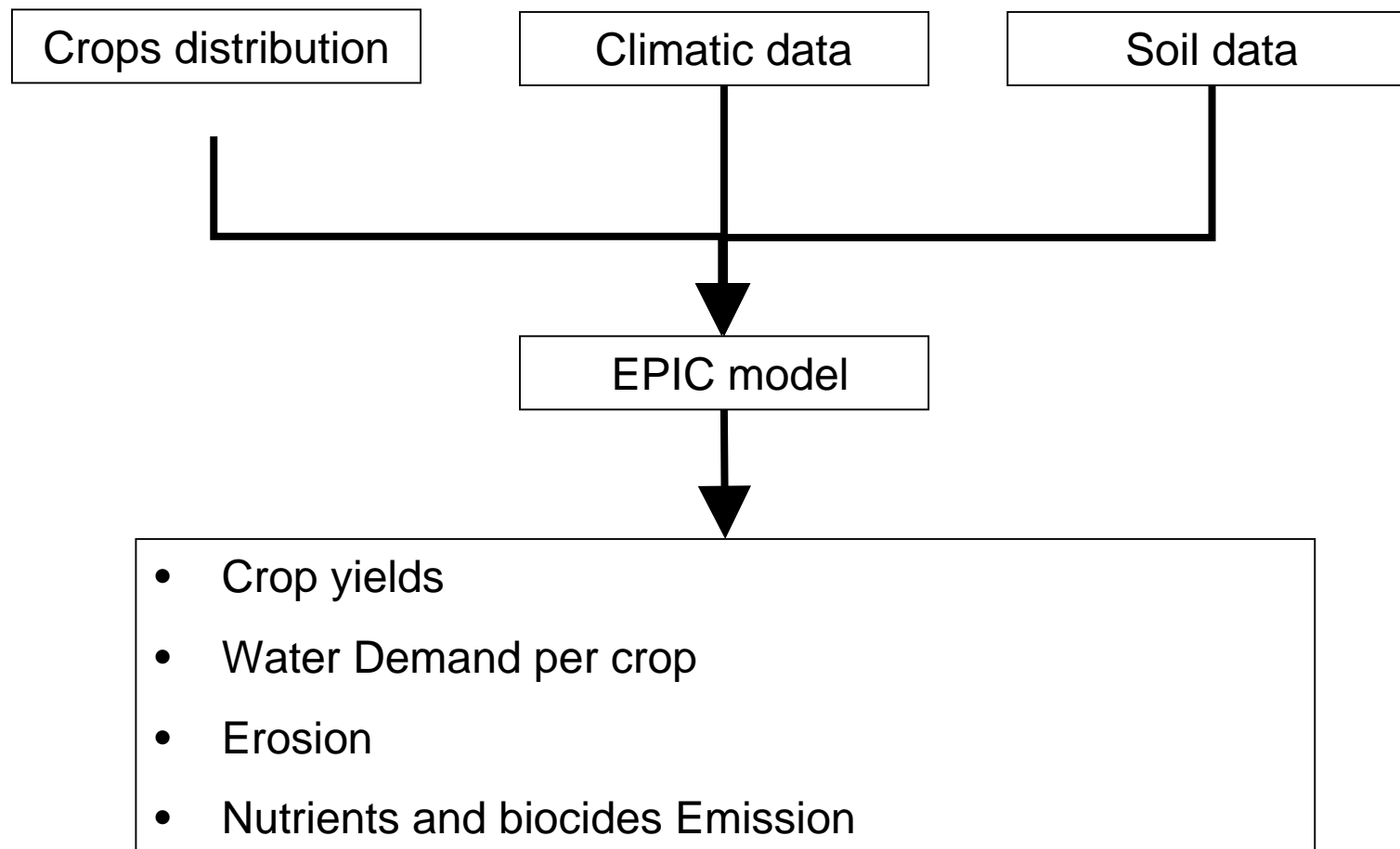
Institut National des
Recherches Agricoles du
Bénin

Structure of the presentation

- **Modeling of crop production at the field scale**
- **Spatial modeling units**
- **Results – verification**
- **Results – scenarios**
- **Conclusions**



The EPIC Model: Modeling of crop production and its effects on the environment at the field scale



The EPIC user interface

The screenshot shows the EPIC user interface with the following components:

- Table:**

#	ID	Description
1	1	1
2	2	3
3	3	6004
- Record 1 of 3:** ID: 1
- Hydrologic Condition:** Good
- Expansion factor, acres:** 0
- Conservation practice:** None
- Tillage:** Conv/NB
- Slope:** 0.0%
- Slope length:** 116.6
- Erosion equation:** 5 MUSI MUSLE
- Erosion control practice factor:** 1.000000
- Dynamic runoff curve number:** 63.0
- Landuse #:** 9
- Weather Station:** Weather Station 2 (Select, Edit)
- Soil:** s2 Soil 2 (Select, Edit)
- Parameters:** Param 2 (Select, Edit)
- Multi-run:** MPRUN 0 (Select, Edit)
- Management:** Run Header, Other Details
- Management 5000:** (Select, Edit)
- Output Yield:** Table, Chart, Chart All Samples



Modeling units at the regional scale

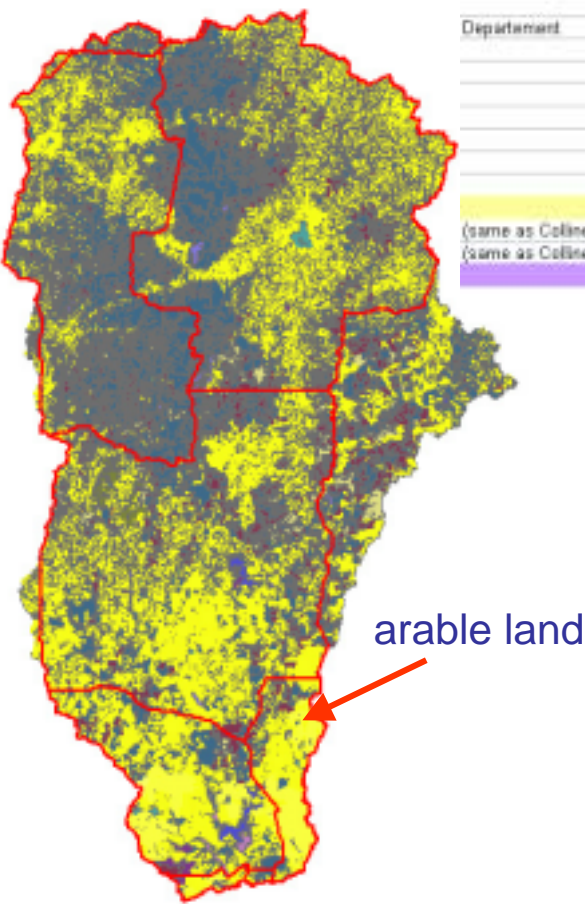
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Example of the Oueme basin

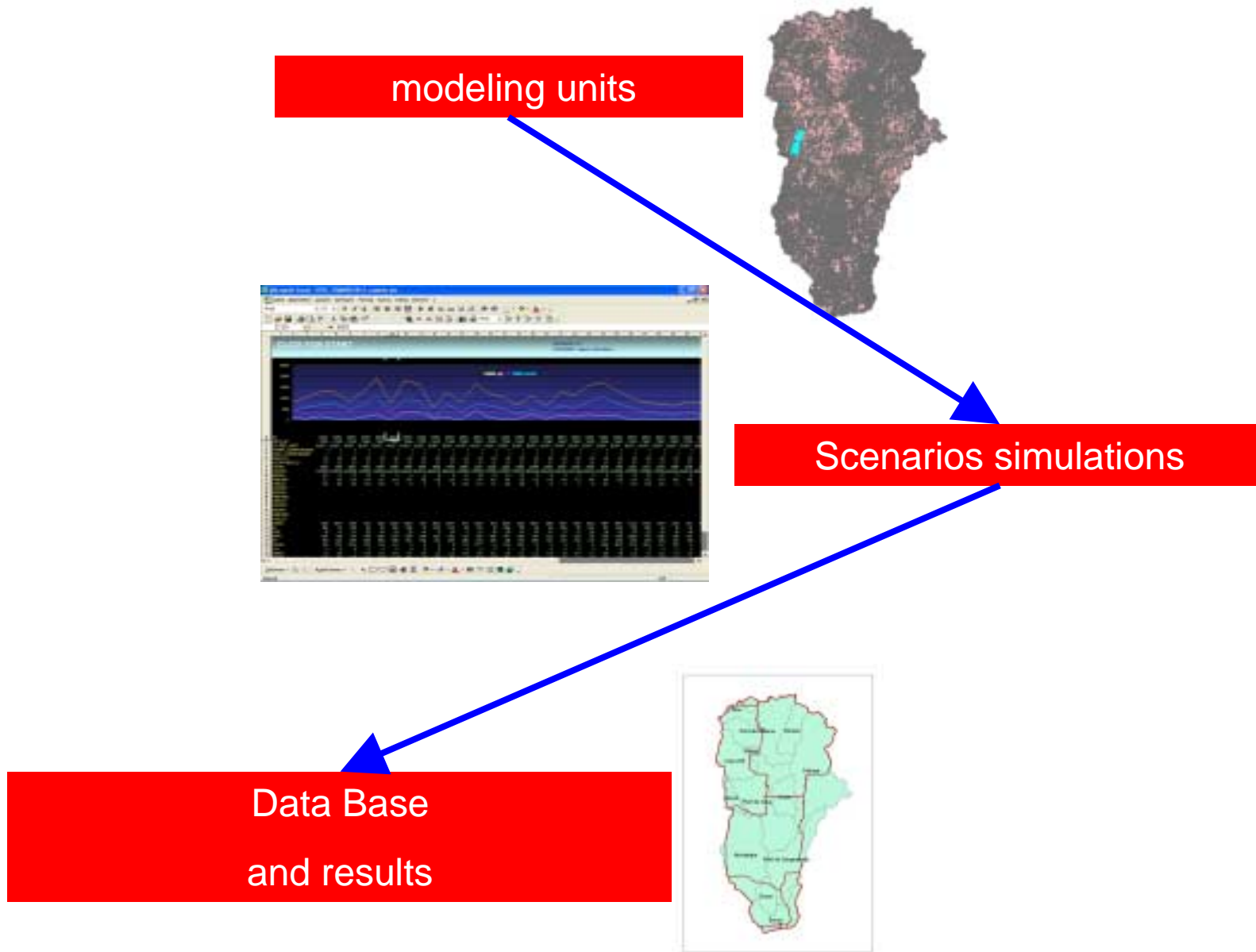
Land use and crop distribution

Selected Crop for Benin in ha for the

Departement	Real arable land									
	Maize mono	Maize/Cass	Maize/Groundnut	Maize-Sorghum	Maize-Maize	Maize amell	Sorghum-45	Rice-450	Sweet Potat	
Atacora	230	143			95		122	624	142	99
Atlantique	2830	1135				568	954	0	0	137
Borgou	20761	12457			8305		10526	19983	1314	224
Colline	14884	8930	5954				30264	5454	3450	352
Donga	3905	2343			1562		2003	12032	2996	987
Oueme	606	243	0			182	94	0	6	97
Plateau	42105	95842	0			12532	6456	0	0	327
Zou	17150	10295	6063				7065	3040	120	1191
(same as Collines) Togo										
(same as Collines) Nigeria										



According to „new“ agricultural statistical data 42 defined monocropping, intercropping and crop fallow rotations were spatially distributed (random distribution) on the arable land for each department



Application of SLISYS in two river basins

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Verification at the regional scale

Oueme basin



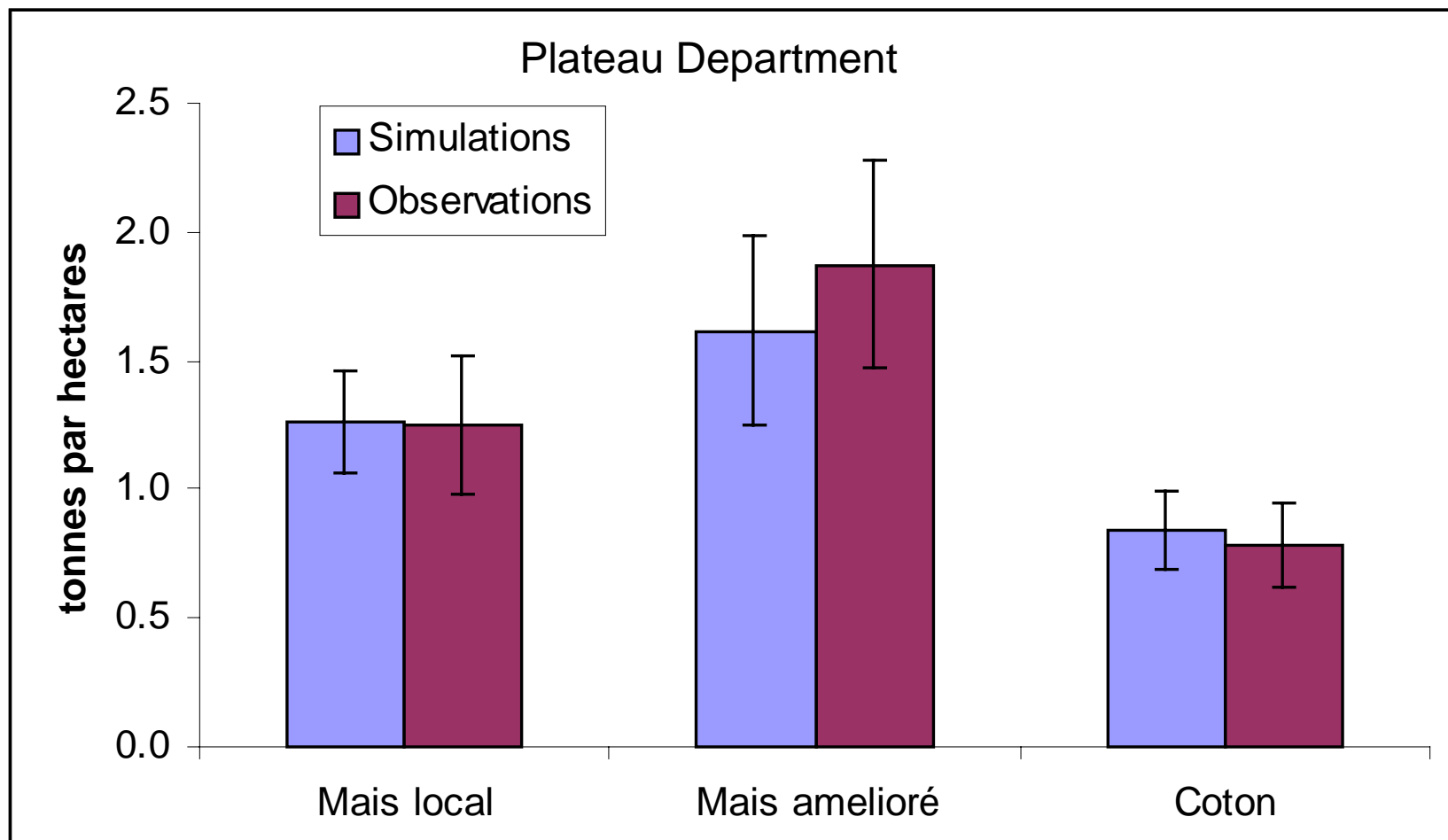
Neckar basin



Oueme basin



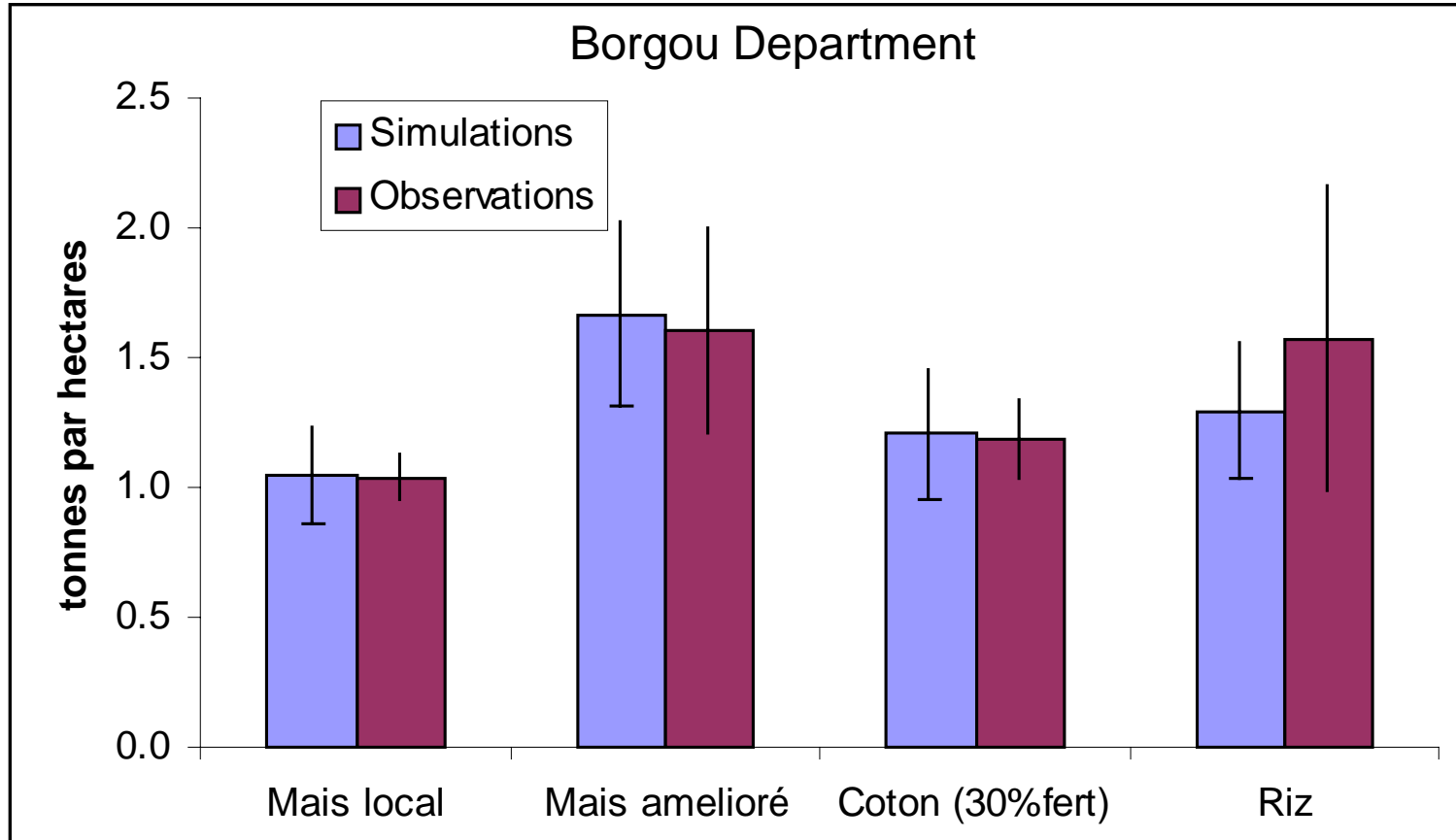
Mean yields in Plateau Department Observations and Simulations (1987-2003)



Oueme basin



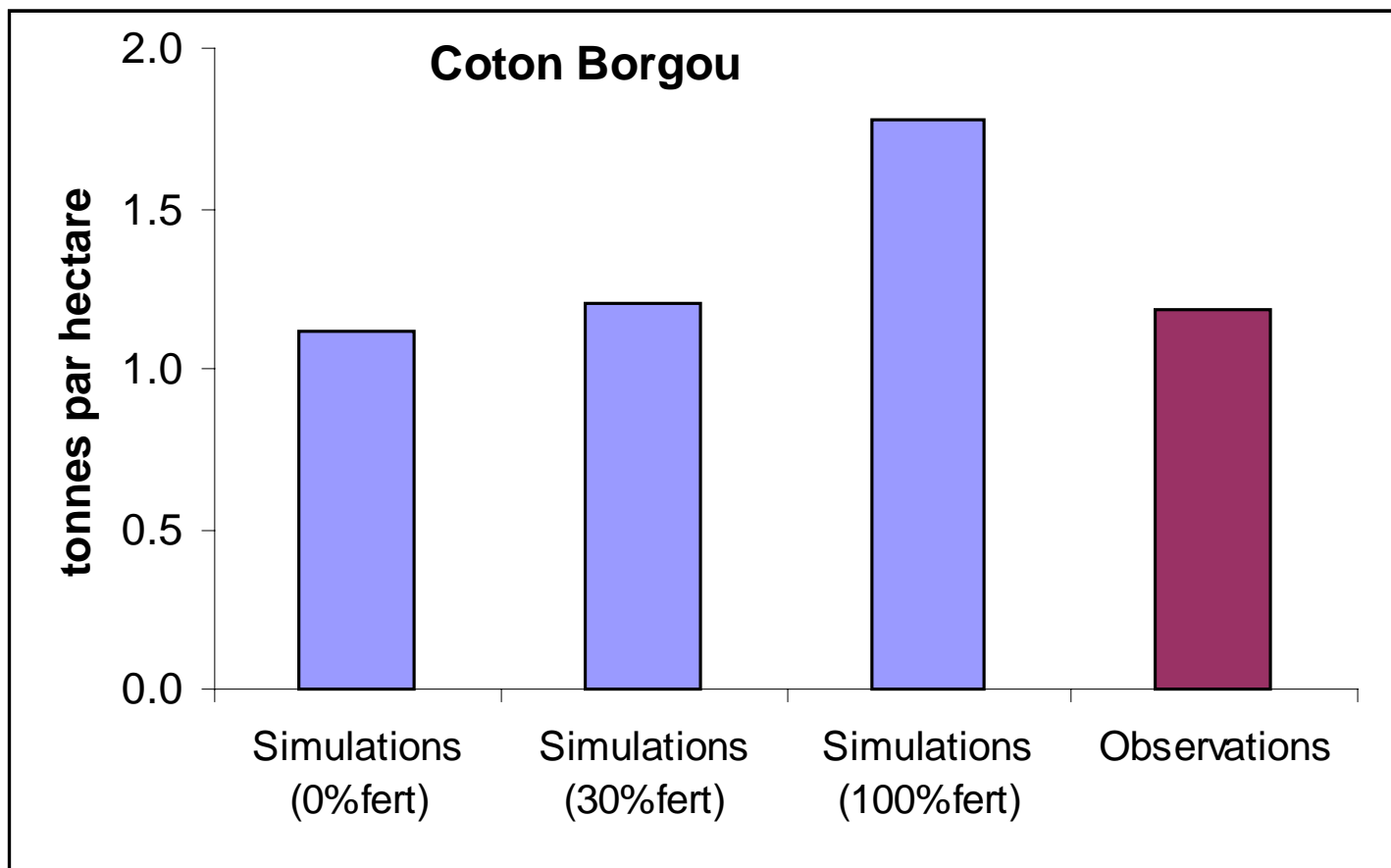
Yields in Borgou department Observations and Simulations



Oueme basin



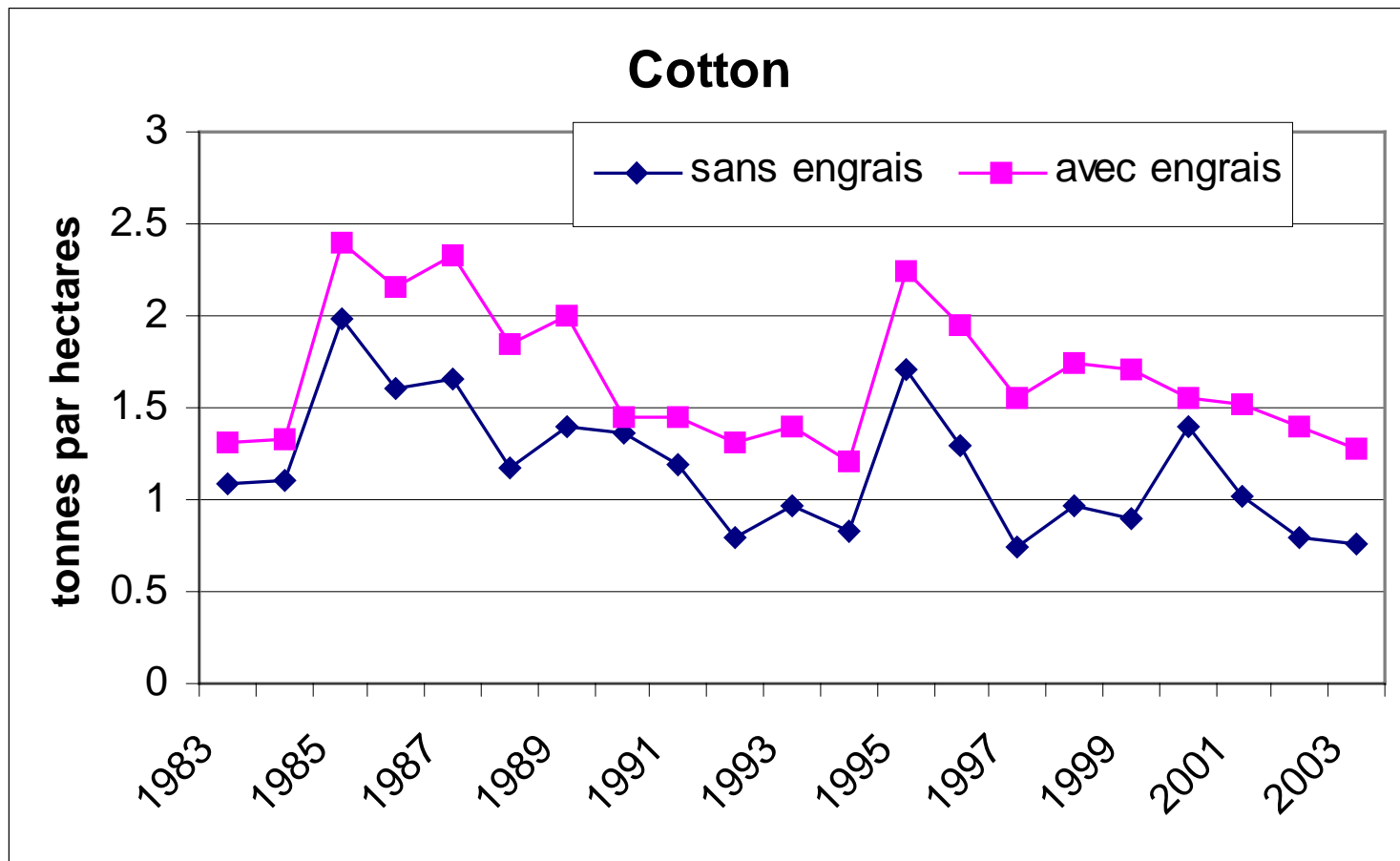
Cotton yield in Borgou Department



Oueme basin



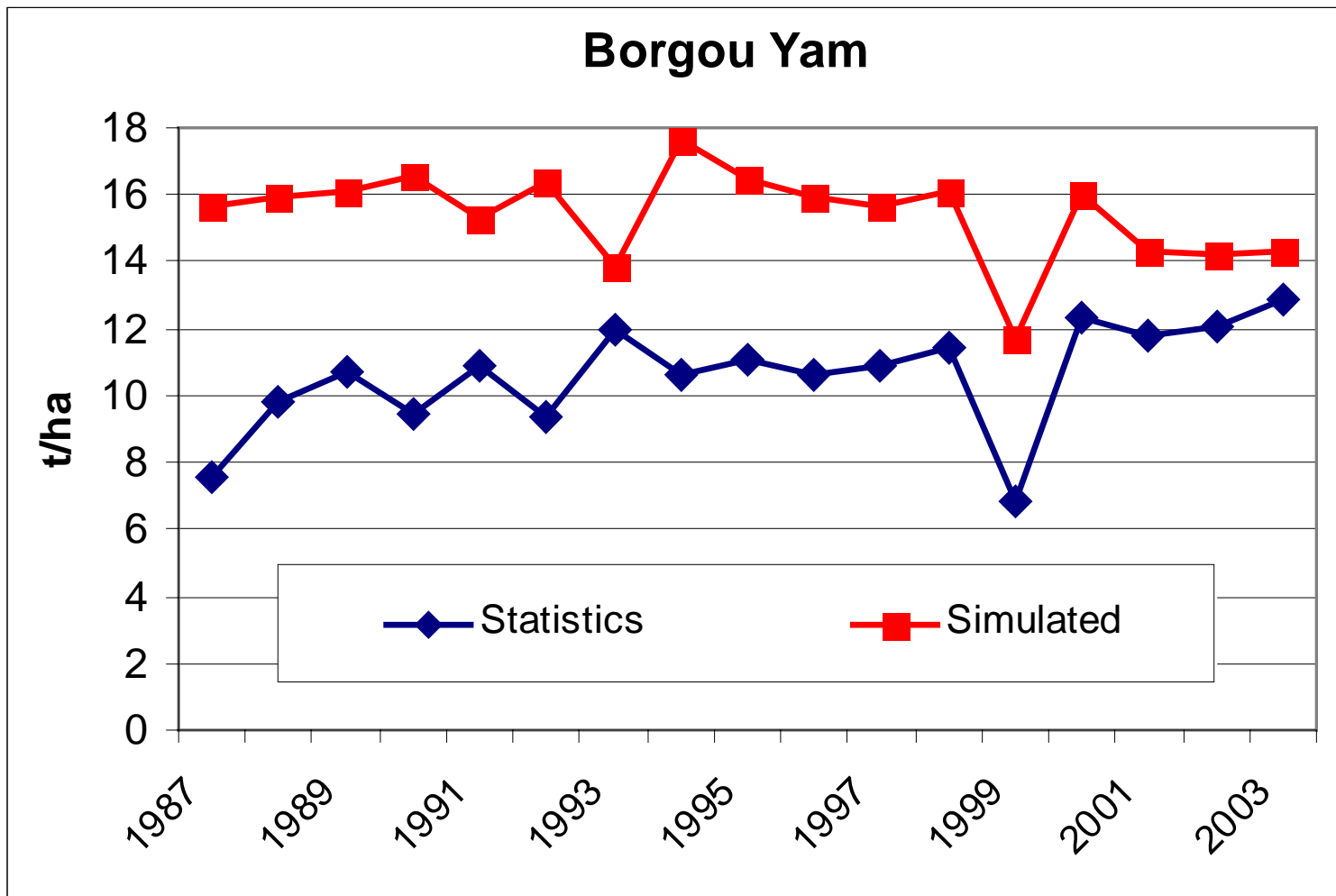
Simulation of yield evolution in relation to fertilizer application



Oueme basin



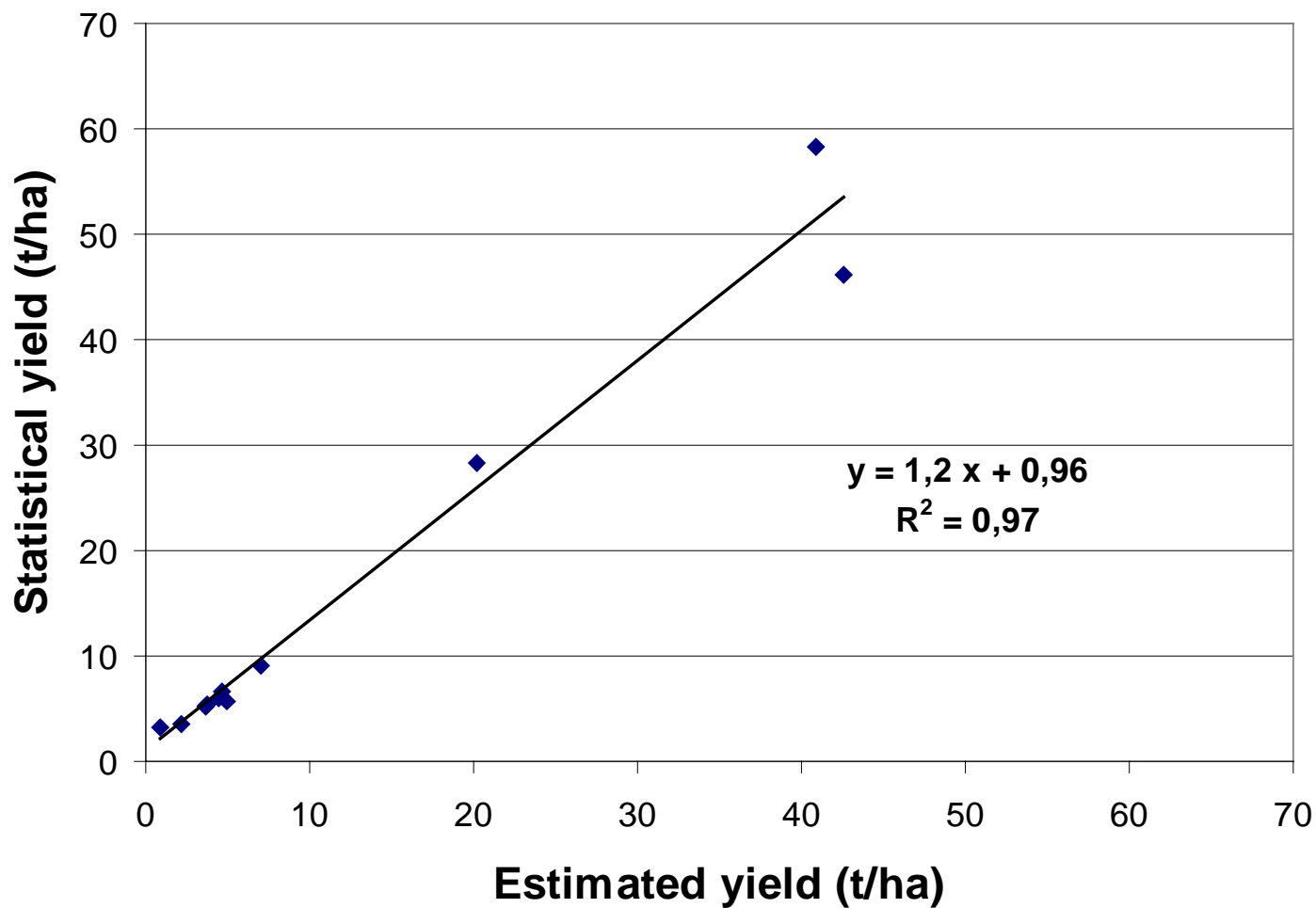
Evolution of Yam yields



Neckar basin



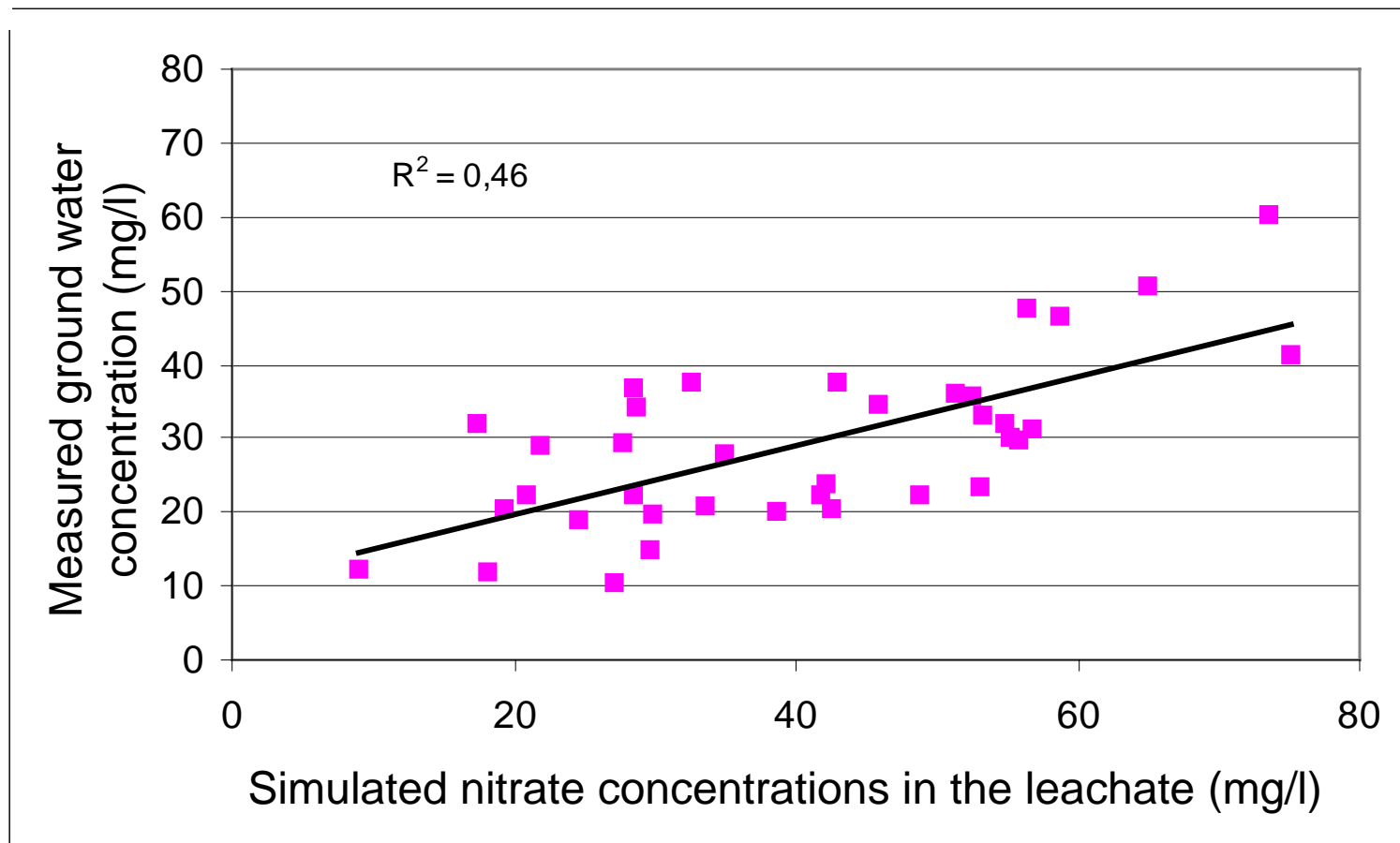
Correlation between mean estimated and statistical crop yields



Neckar basin



Correlation between measured mean nitrate concentrations in the groundwater and simulated concentrations in the leachate





Results - Scenarios

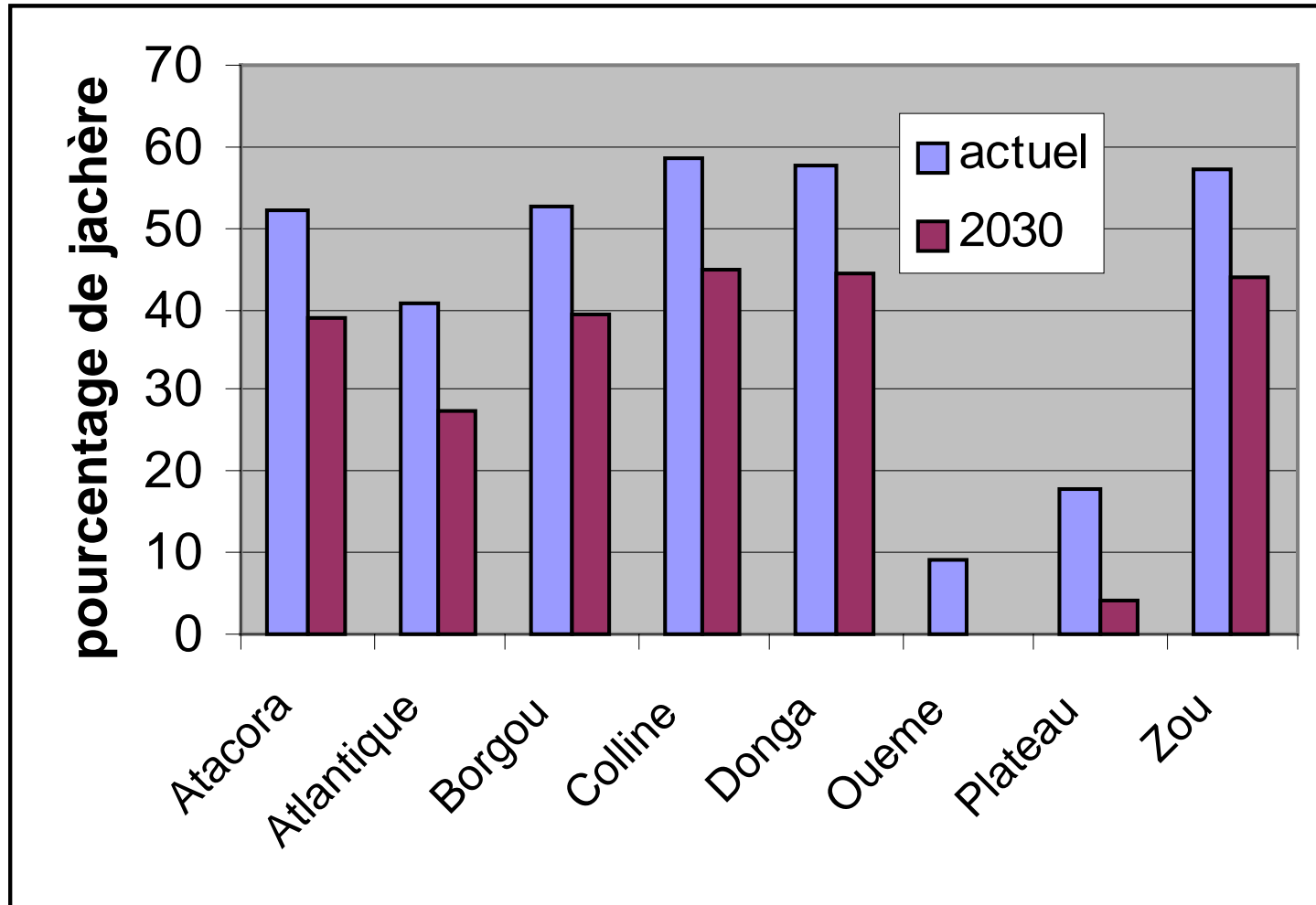


Effects of land use scenarios on crop yields

Oueme basin



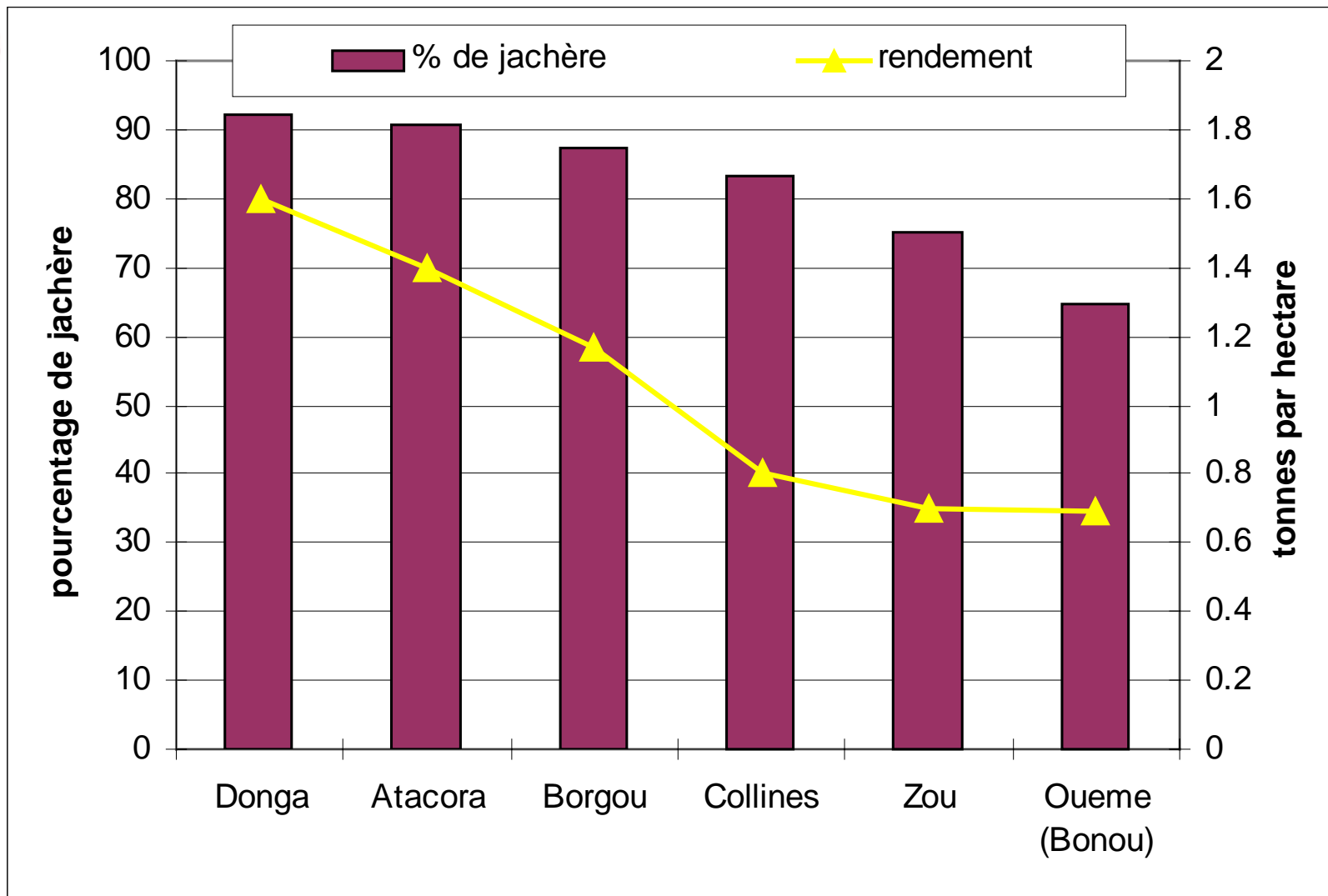
Reduction of fallows per department



Oueme basin

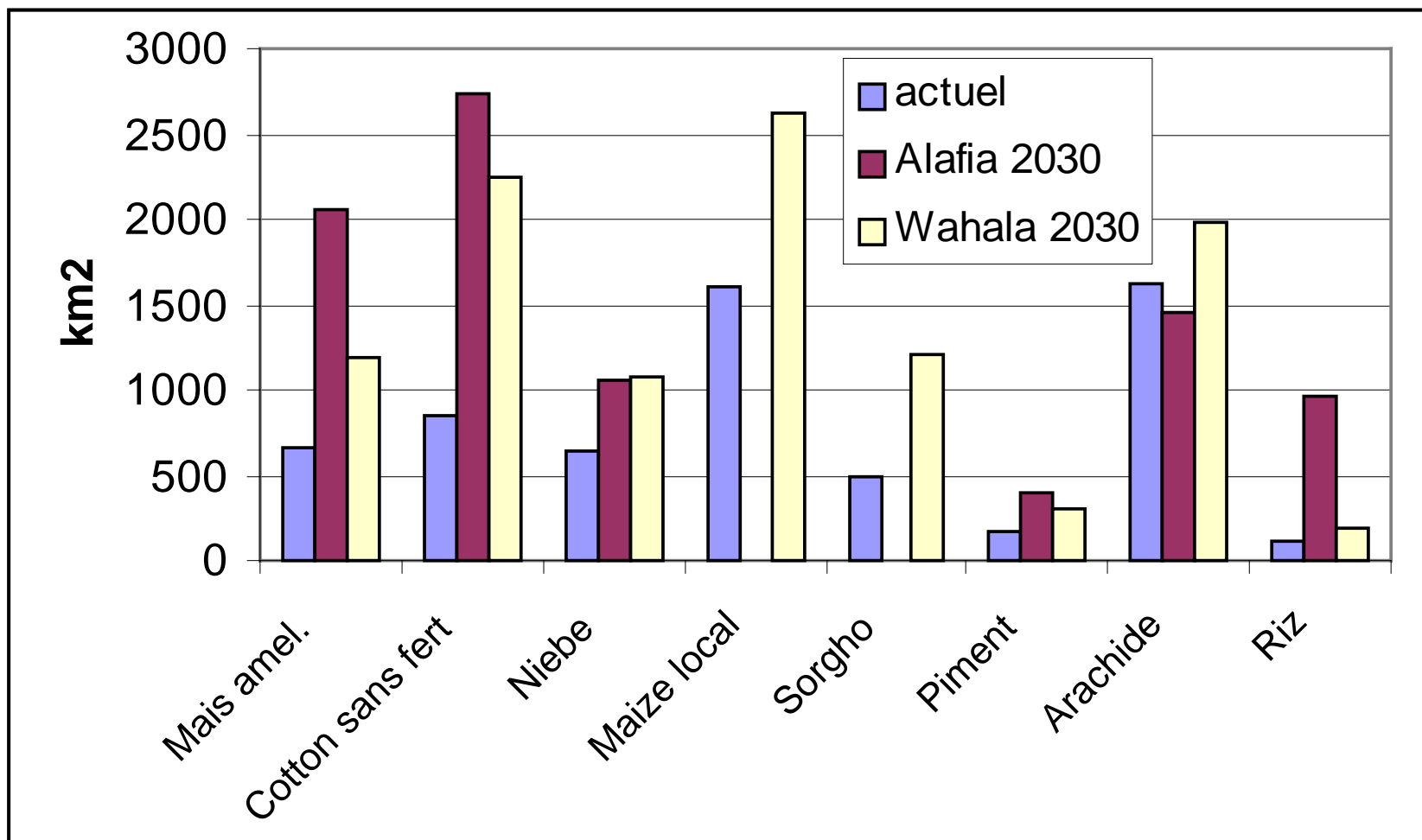


Effect of percentage of fallow on maize yield



Oueme basin

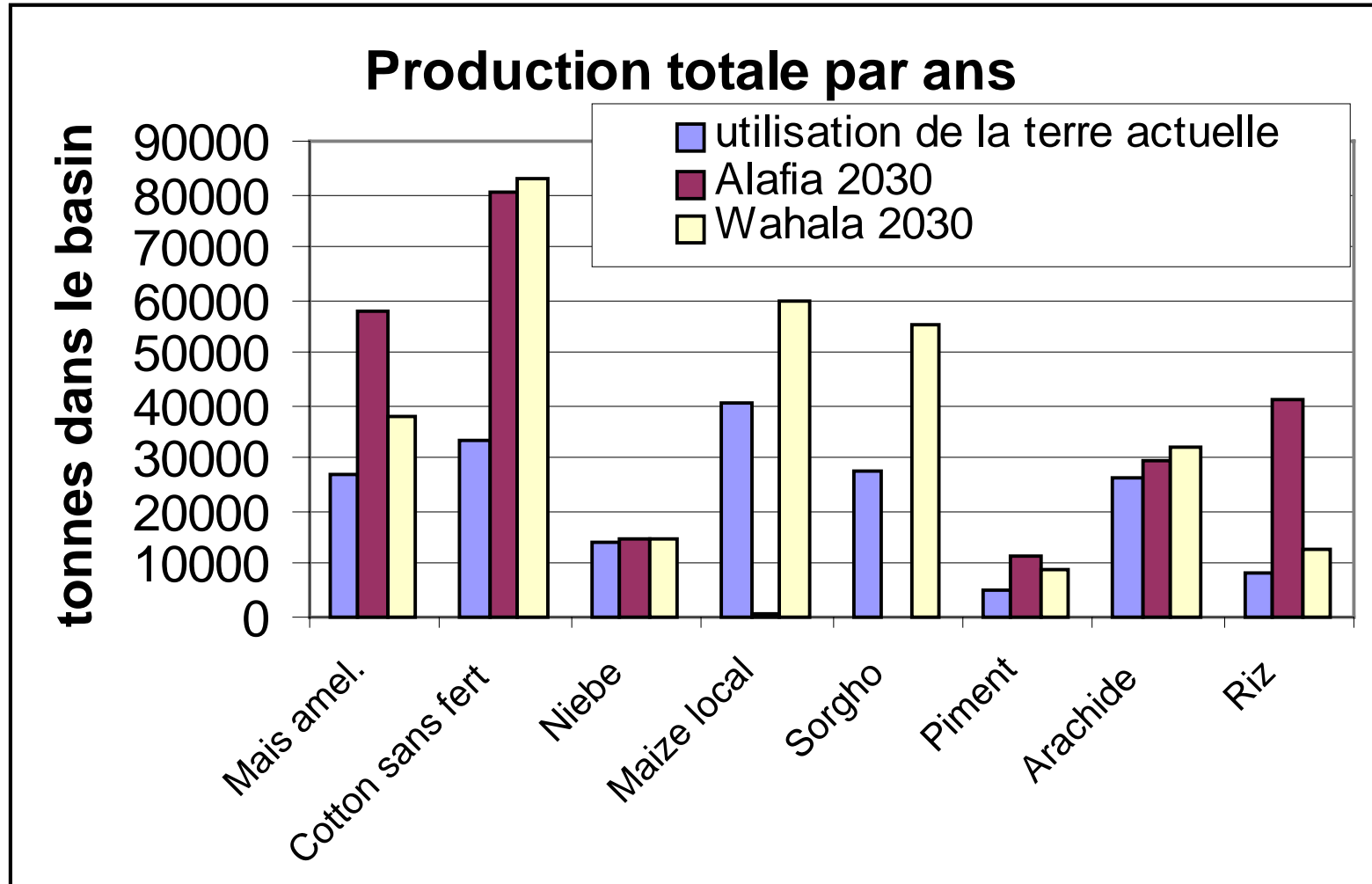
Comparison of planted areas



Oueme basin



Comparison of agriculture productivity



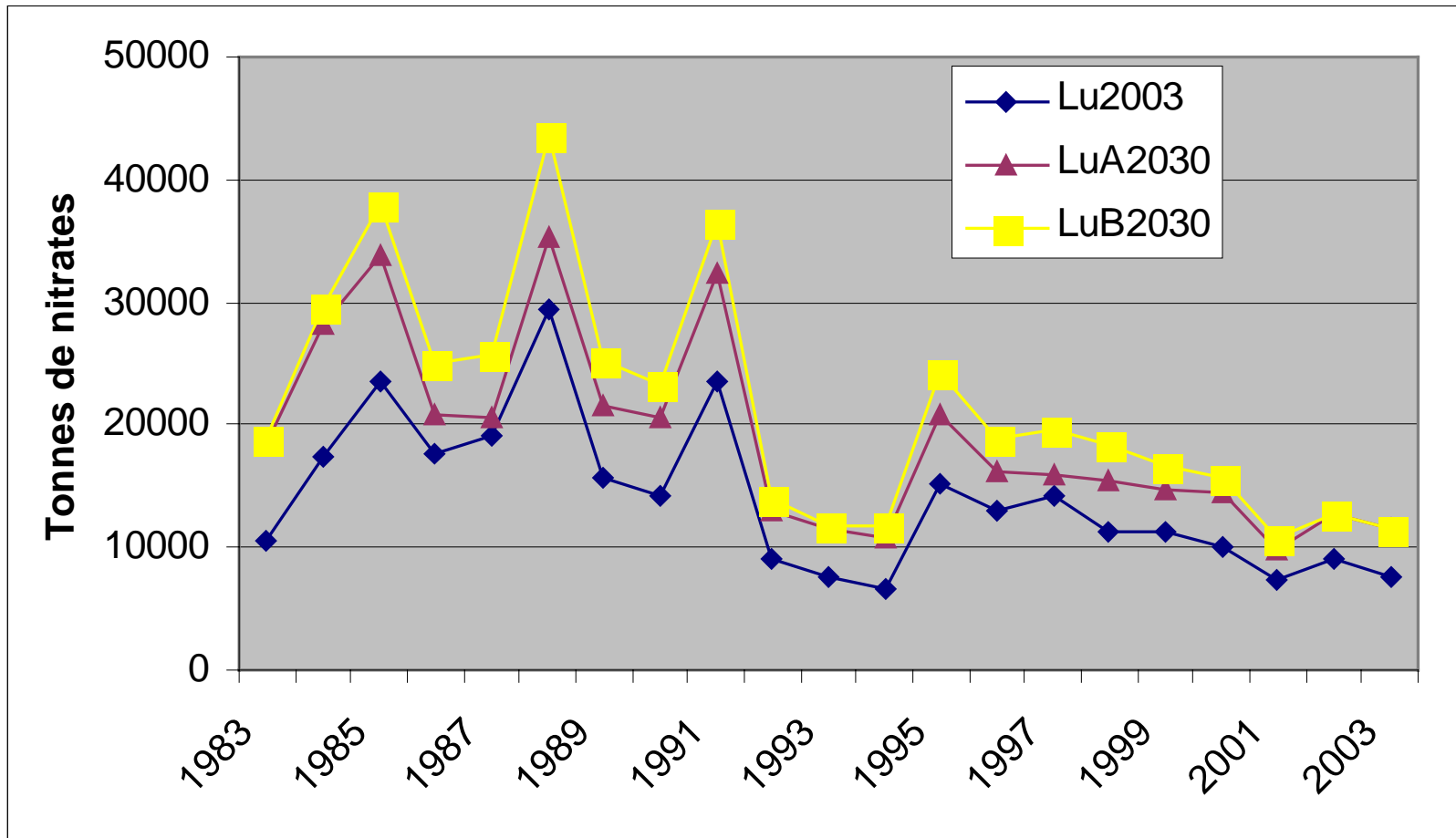


Effects of land use scenarios on the environment

Oueme basin



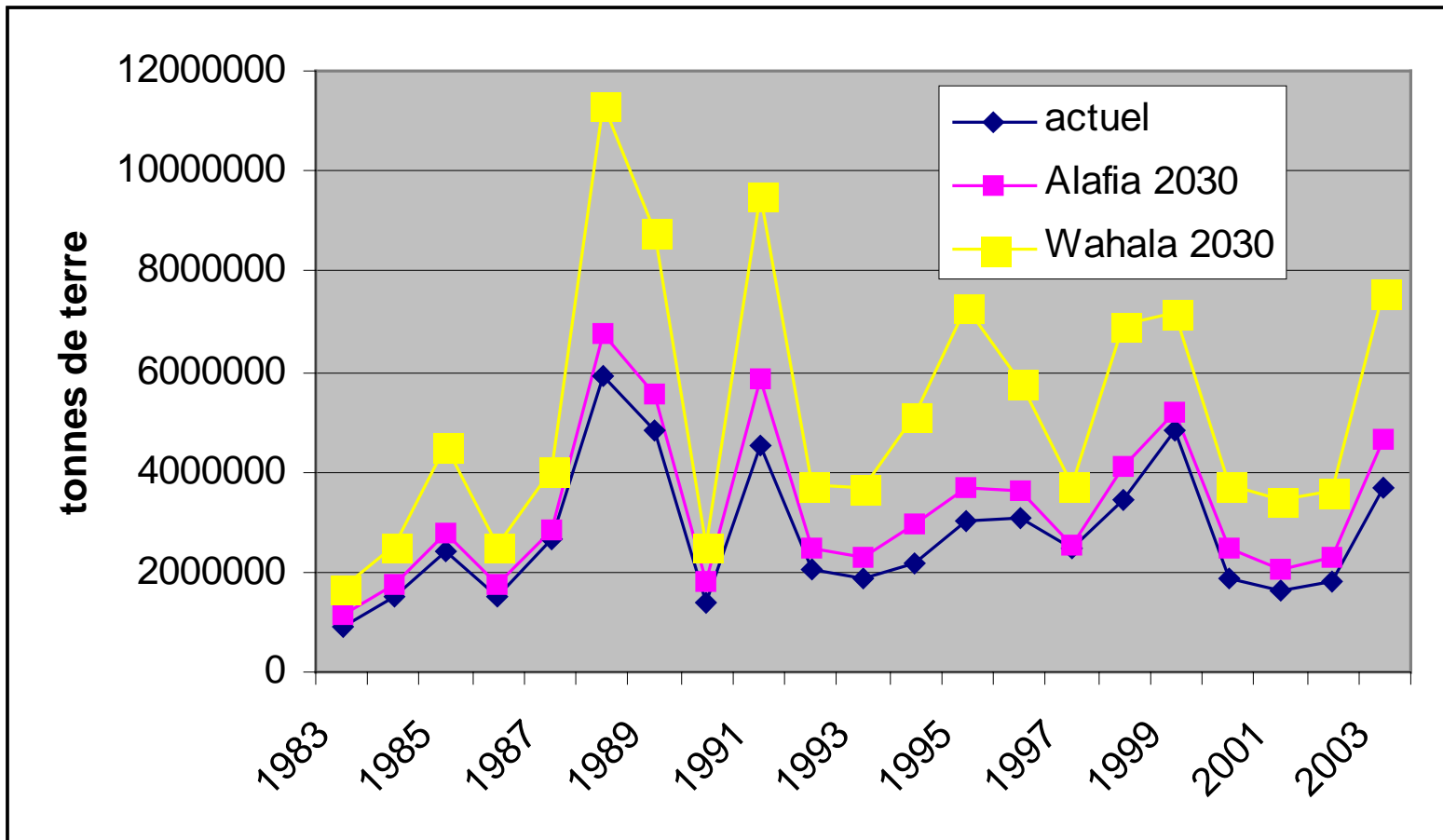
Compraison of groundwater pollution by nitrate



Oueme basin



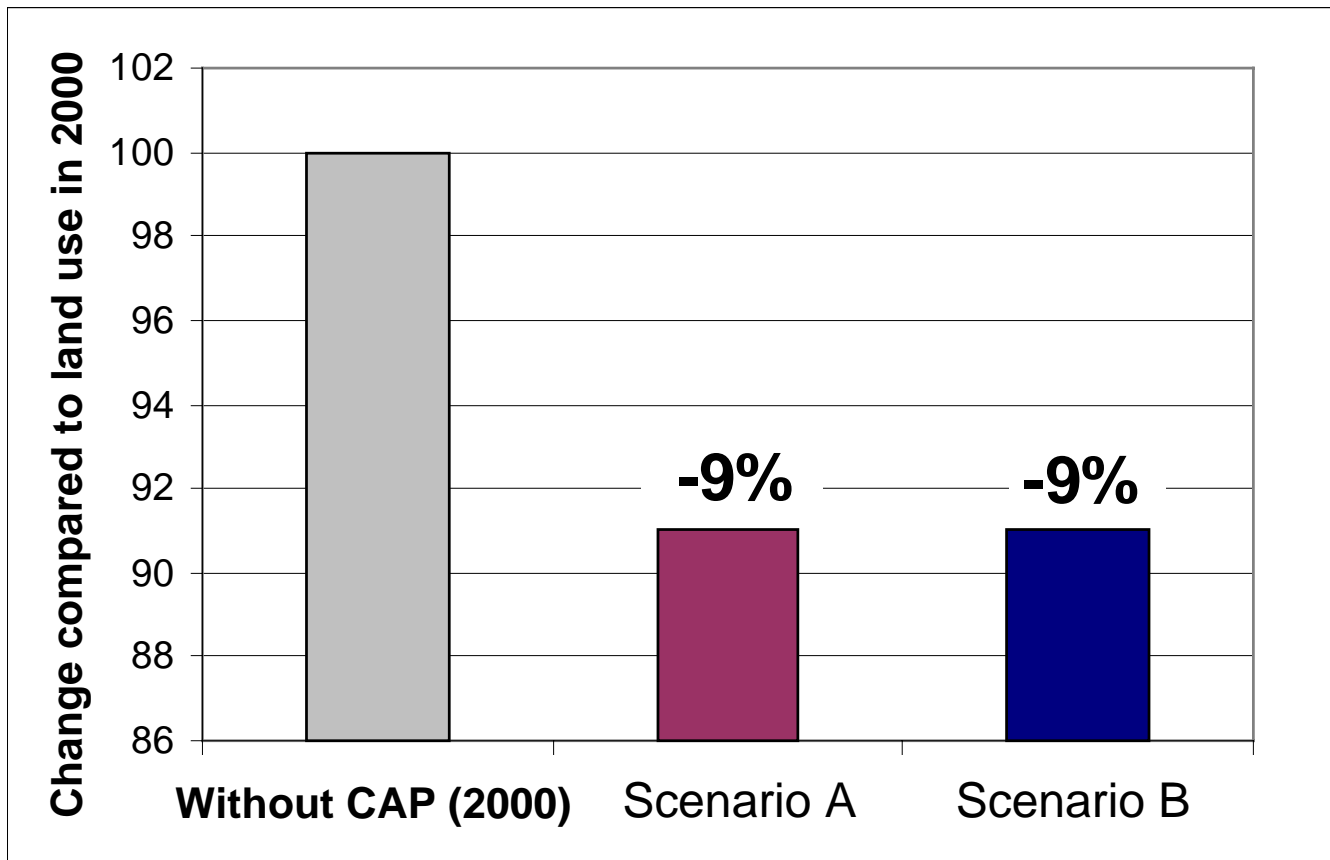
Comparison erosion intensity



Neckar basin



Effect of the EU Common Agricultural Policy (CAP) (Scenario A and B) on nitrate loads



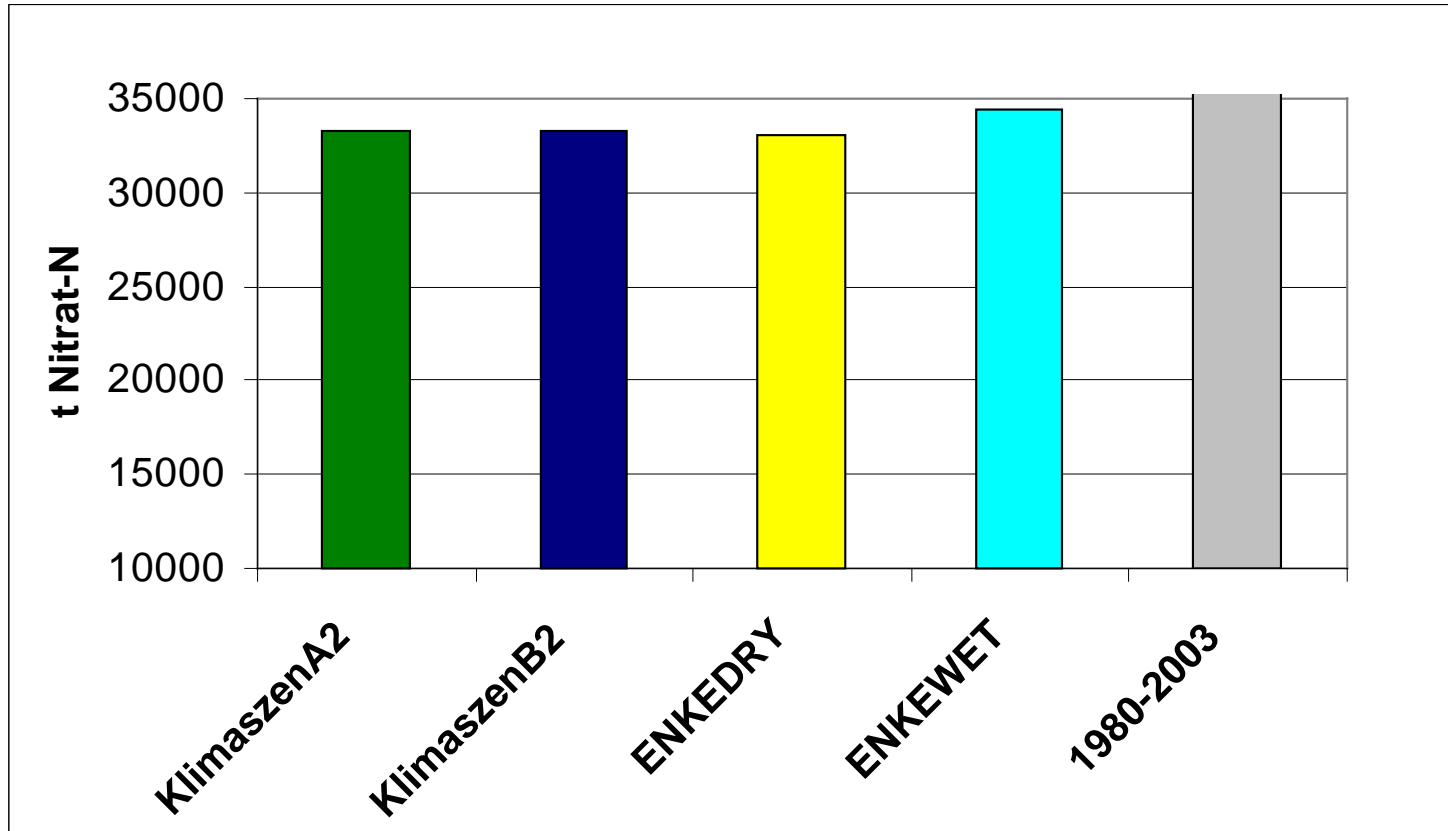


Effects of climate scenarios on the environment

Neckar basin



Mean annual nitrate loads to the ground water in the Neckar basin in four climate scenarios



Conclusions (Neckar basin)

Model calibration:

- The yield estimations for most important crops are closely correlated with statistical data
- Nitrate concentration at the regional scale is well correlated with groundwater concentrations

Scenario calculations:

- The changes in land use due to the new EU common agricultural policy will reduce nitrate loads to ground water bodies compared to land use in the year 2000
- All climate change scenarios point to a reduction of nitrate leaching in the future under constant land use

Conclusions (Oueme basin)

Model calibration:

- In spite of low density of climate stations the simulated yields of most crops are comparable to the statistics
- Simulation of yam yield and tree crops is not satisfactory, because of lack of calibration data

In general there is a lack of data for model validation with respect to water quality

Scenario calculations:

- The changes in land use in all scenarios will cause a strong decline in crop productivity in the Southern part of the basin due to shortening of the fallow periods
- The total agricultural production will increase tremendously due to expansion of agricultural land
- The expansion of agricultural land will cause an increase in soil erosion and nitrate leaching if the actual soil and crop management pertains

THANK YOU FOR YOUR ATTENTION

