

Productivity and water use efficiency of maize in the “Upper Ouémé Catchment” North of Bénin

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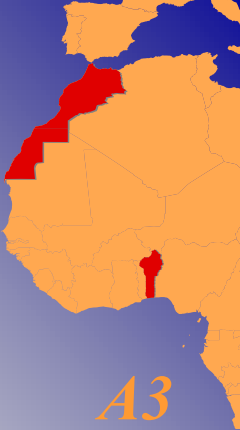


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Structure



1. Introduction

2. Problem statement

3. Objectives

4. Material and Methods

5. Results and Discussion

6. Conclusions

Introduction

Problem

Objectives

Material/Methods

Results

Conclusions



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Problem statement

Low crop productivity in O.S.

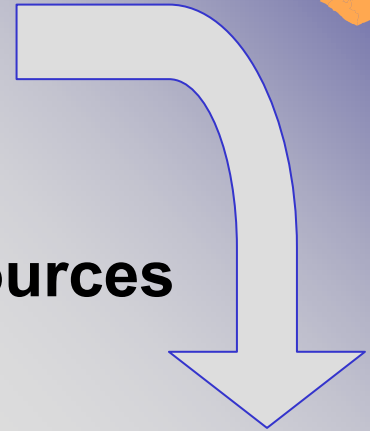
Increasing population:

→ increasing pressure on land resources

inefficient use of available water resources

Approach:

→ Identification of limiting nutrients for higher crop productivity



Introduction

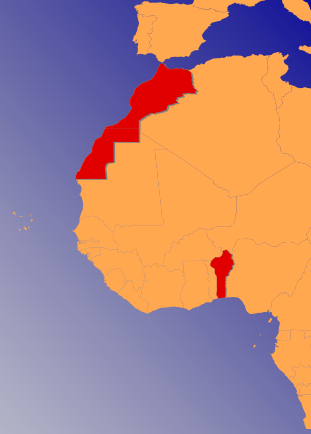
Problem

Objectives

Material/Methods

Results

Conclusions



Working Hypothesis

Introduction

Problem

Objectives

Material/Methods

Results

Conclusions

- **Organic matter and/or mineral fertilizers improve crop yields and crop WUE in the Upper Ouémé catchment.**



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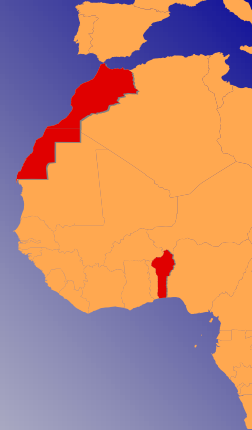


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Objectives of the study; expected benefits



Introduction

Problem

Objectives

Material/Methods

Results

Conclusions

Objective: to assess the effect of organic and mineral fertilizer on maize yield and its water use efficiency in the Upper Ouémé Catchment.

Better management systems are expected to:

- increase and stabilize yields**
- improve the WUE of crops**
- reduce pressure on existing land resources and natural vegetation**



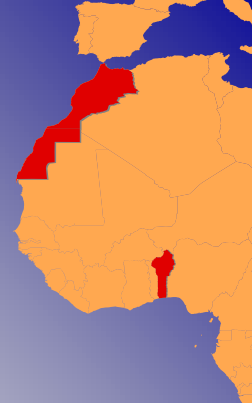
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Plot distribution in the project area



Introduction

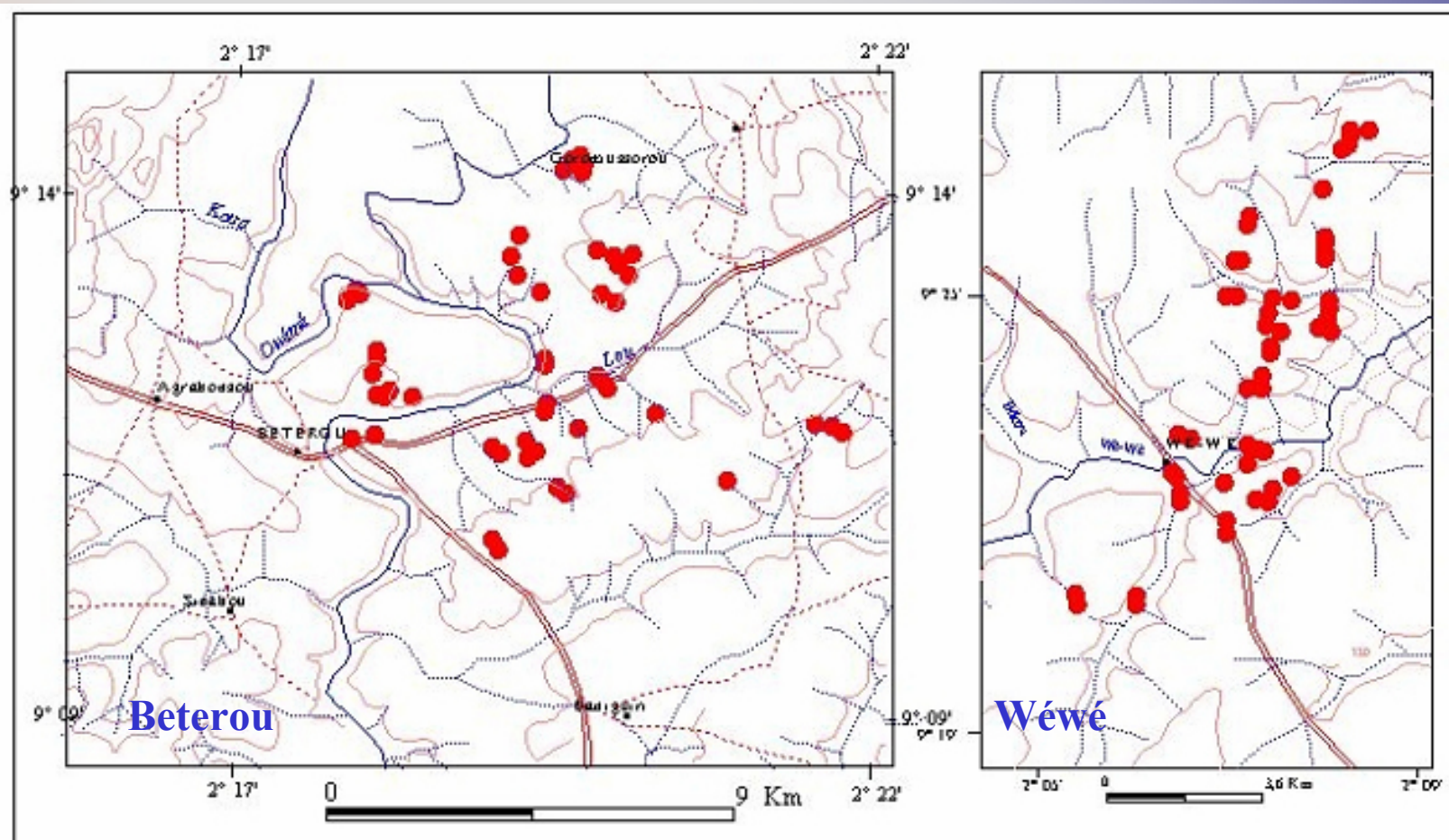
Problem

Objectives

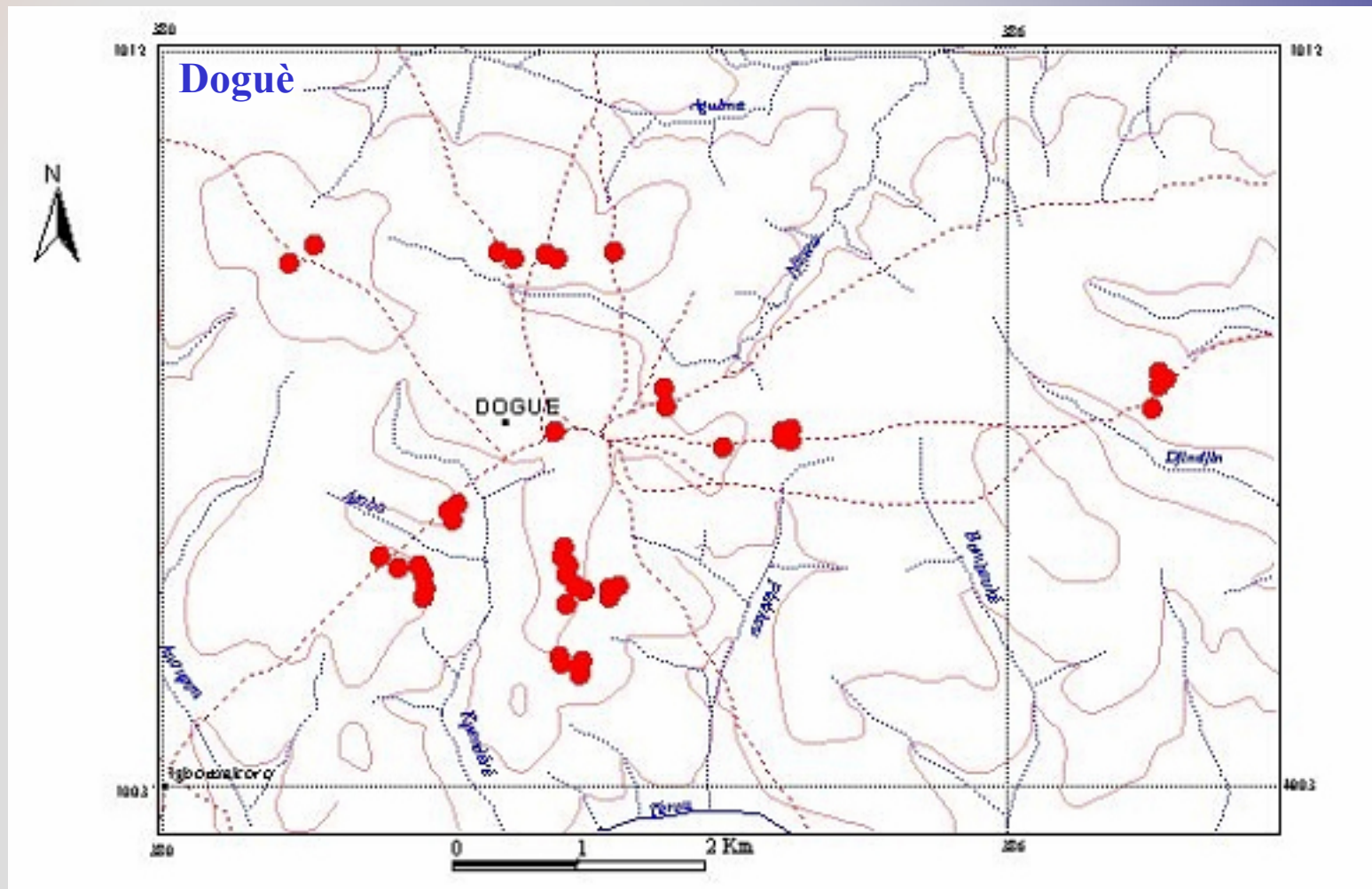
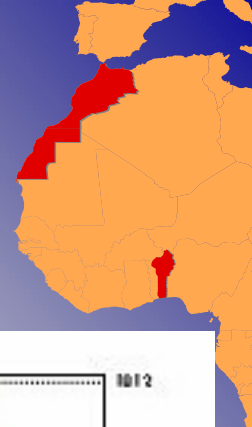
Material/Methods

Results

Conclusions



Plot distribution in the project area



Introduction

Problem

Objectives

Material/Methods

Results

Conclusions



Materials and Methods



- **Experimental design**

Randomized complete block. Farmers as blocks or replicates depending on the site.

Introduction

Problem

Objectives

Material/Methods

Results

Conclusions

Treatments

T0: plots without fertilizer or organic matter applied

T1: 10 T ha⁻¹ organic matter (mulch / manure)

T2: 60 N 40P₂O₅ in 2001 and 75N 40P₂O₅ 24 K₂O in 2002

T3: 60 N 40 P₂O₅ in 2001 and 75N 40 P₂O₅ 24 K₂O in 2002 and 10 T ha⁻¹ organic matter

Harvest

- Grain
- residual biomass (foliage, straw, stem, stalks)



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bmb+f



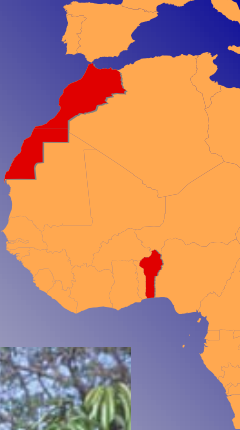
MSWF

NRW.

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Methods



Introduction

Problem

Objectives

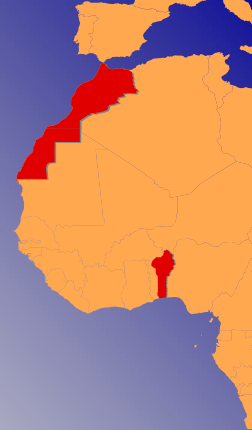
Material/Methods

Results

Conclusions



Definitions of water use efficiency



Introduction

Problem

Objectives

Material/Methods

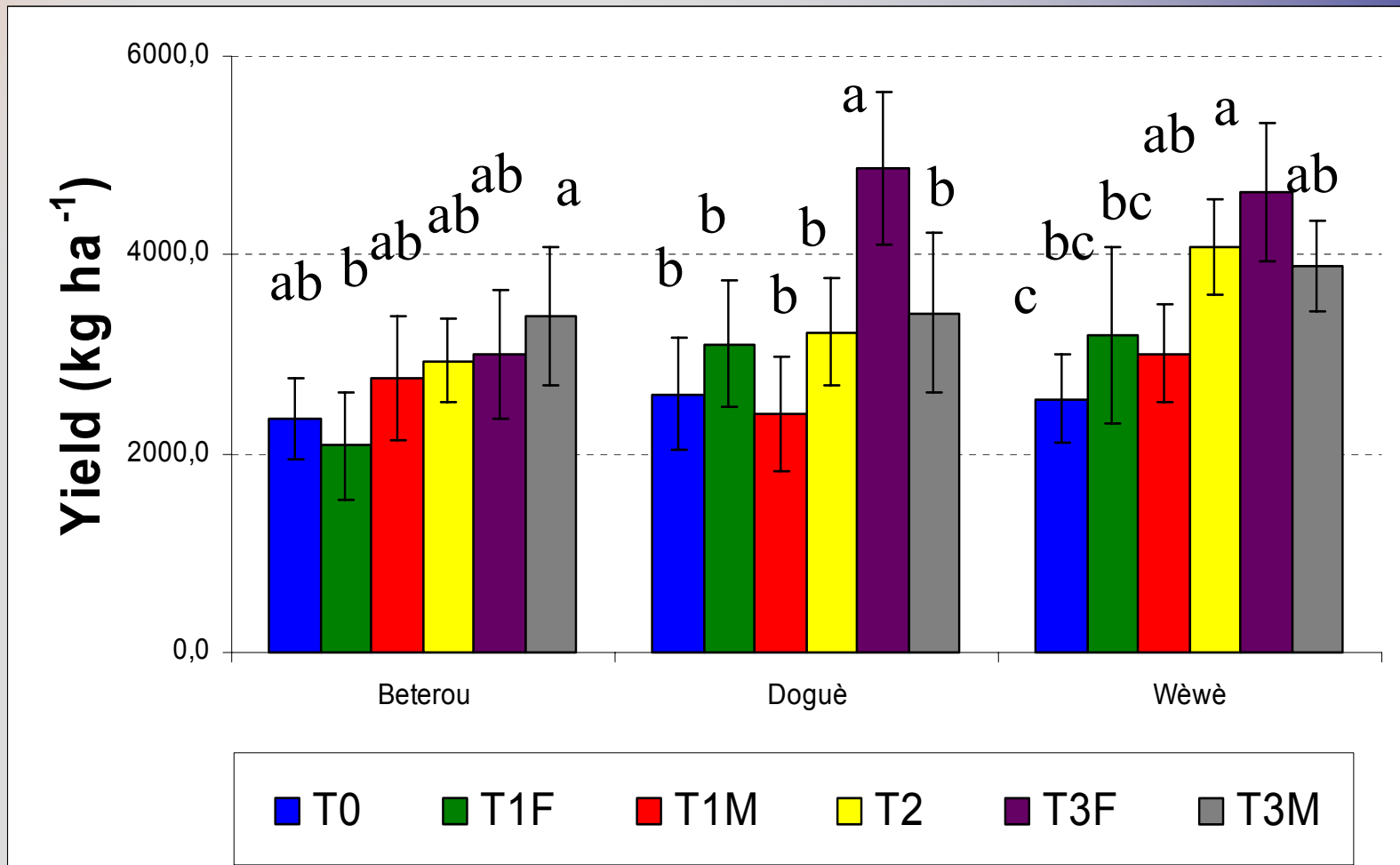
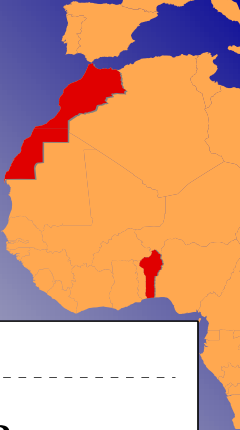
Results

Conclusions

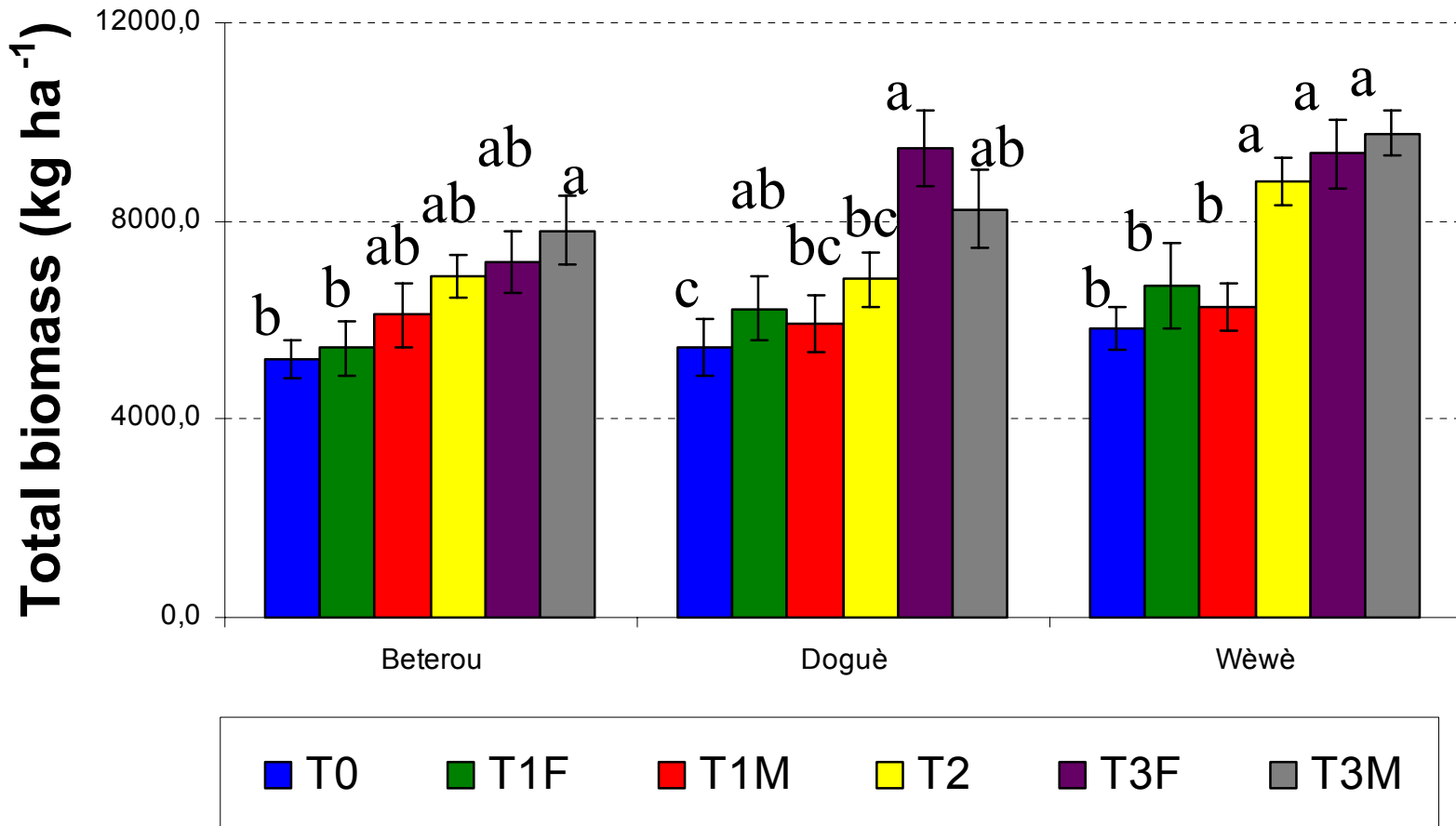
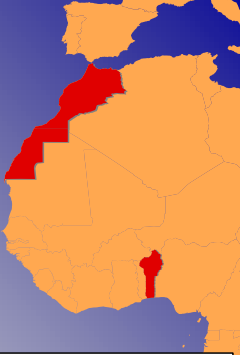
- ▶ Ratio between residual biomass or product of each crop and the amount of annual rainfall
- ▶ Ratio between residual biomass or product and actual evapo-transpiration acc. to RIJTEMA and ABOUKHALED (FAO, 1987)

- $ETR = ETM = \frac{-dRtD}{dt}$ if $Rt.D \geq (1-p) Ru.D$
- $ETR = \frac{RtD}{(1-p)RU}$ if $Rt.D \leq (1-p) Ru.D$

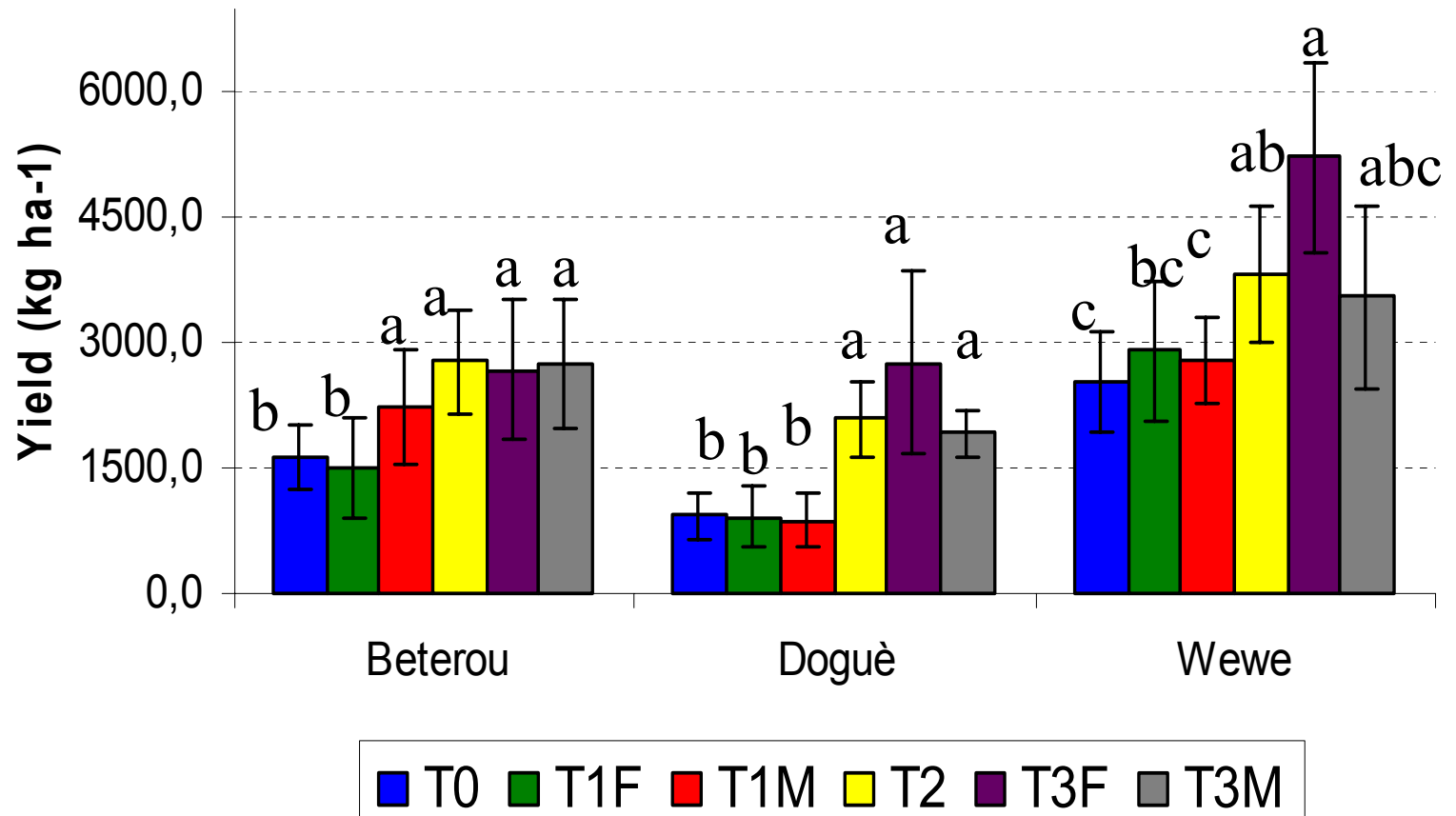
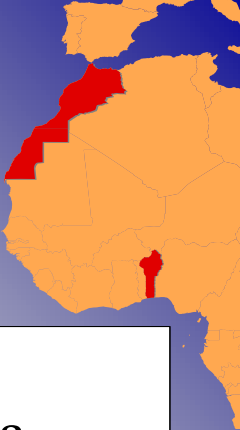
Maize yield 2001



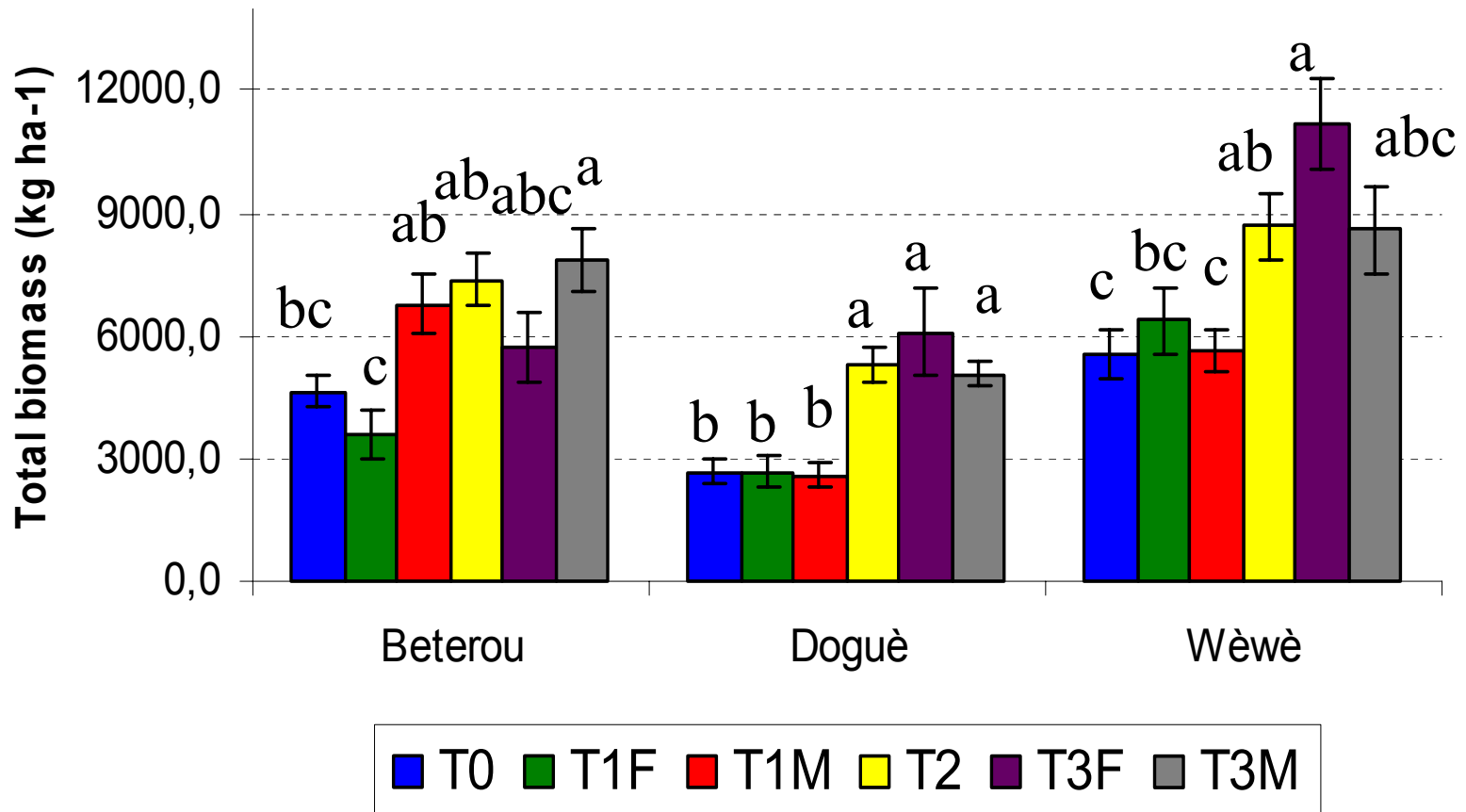
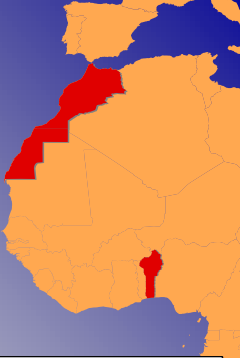
Total biomass 2001



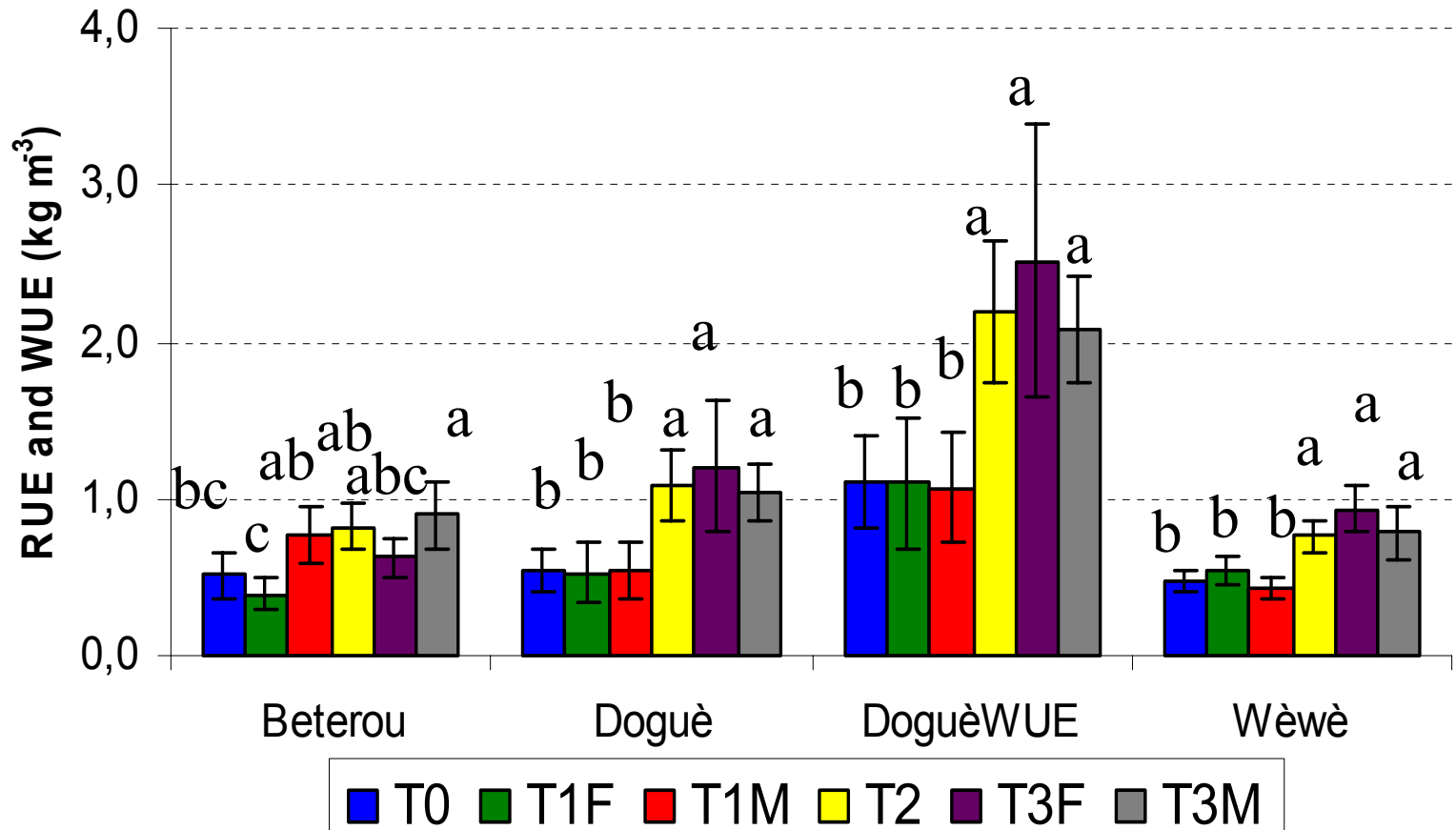
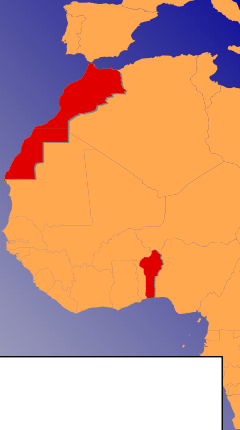
Yield maize 2002



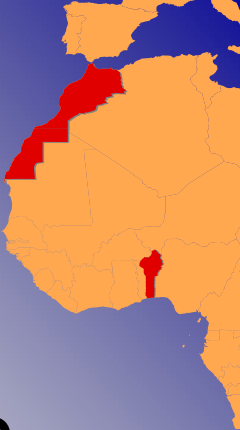
Total biomass 2002



Rainfall and water use efficiencies



Nutrient status of maize in O.S

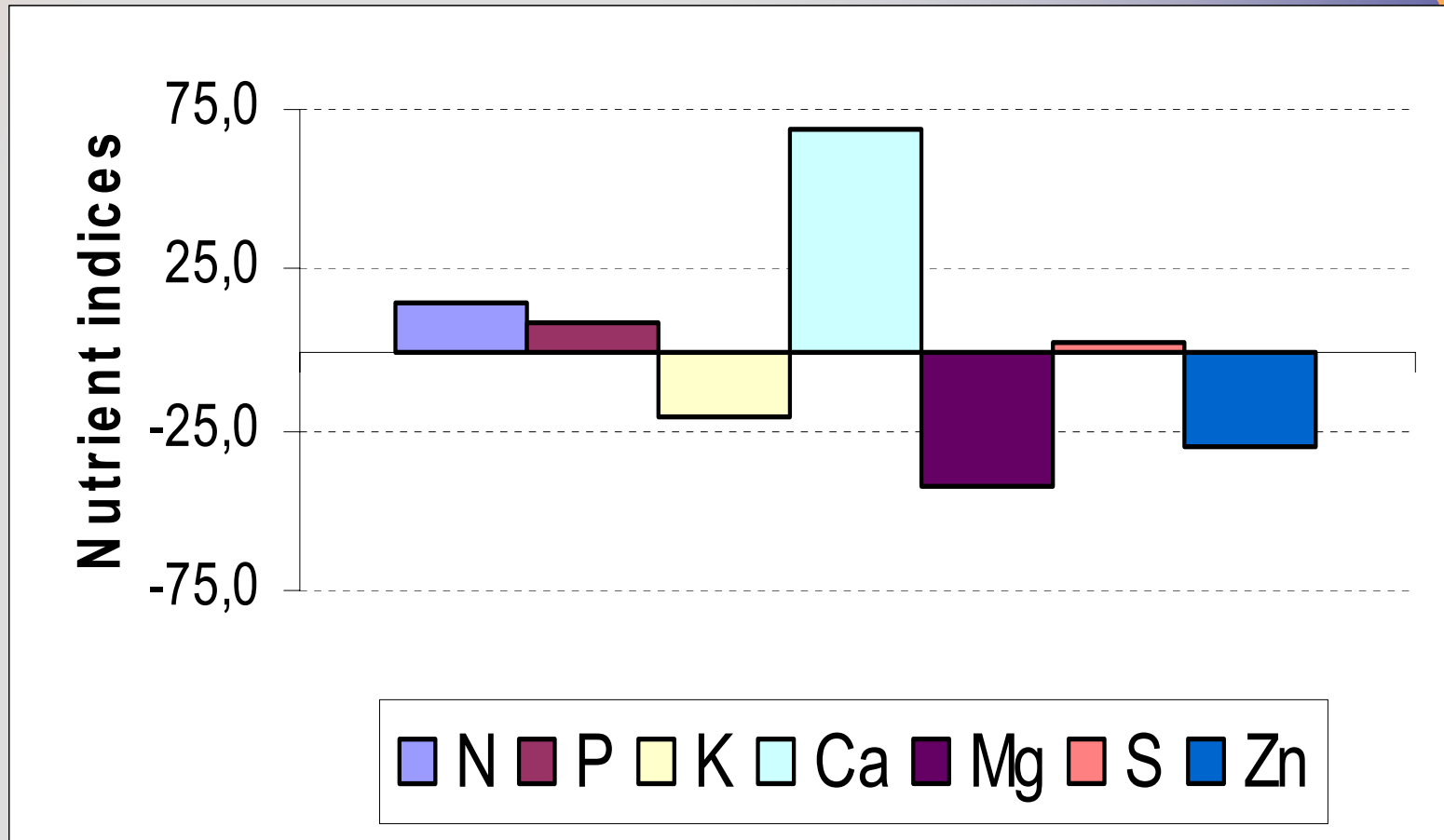
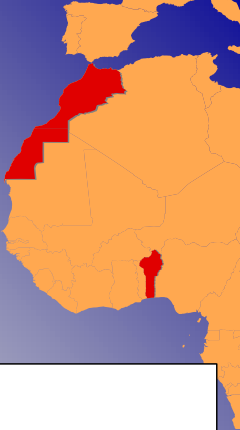


- Fertilizer application did not always lead to significant yield increases: further nutrient limitations?
- Diagnostic fertilizer experiments for all nutrients, all crops, and all sites impossible to handle

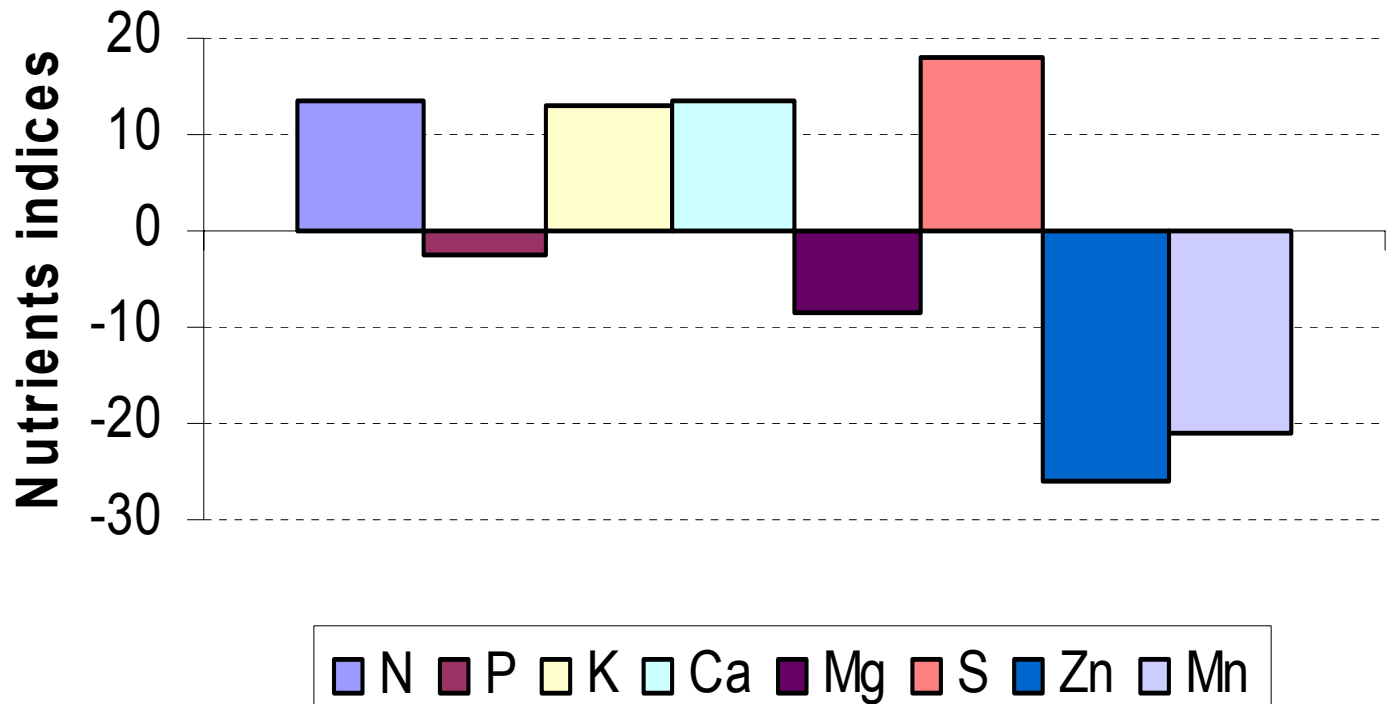
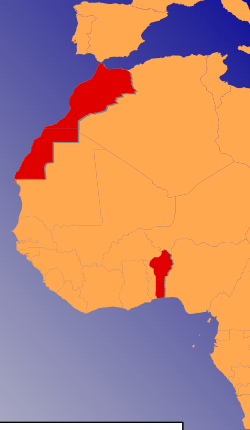
Nutrient status of crops thus evaluated by:

- nutrient concentrations in leaves
- evaluation by DRIS: uses ratios between nutrients (more constant and sometimes more reliable indicators)

DRIS nutrient indices 2001



DRIS nutrient indices 2002



Introduction

Problem

Objectives

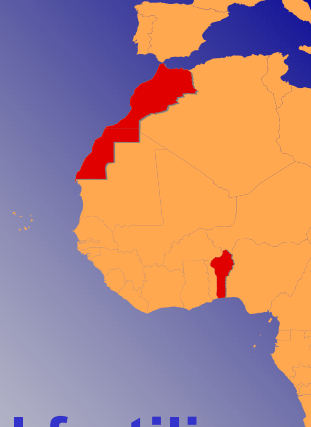
Material/Methods

Results

Conclusions



Conclusions I



→ Organic manuring or mulch and mineral fertilizer

at the officially recommended dose influenced

maize yields positively.

→ Combination of organic and mineral fertilizer

increased yields, but the influence of mineral

fertilizer was more pronounced.

Introduction

Problem

Objectives

Material/Methods

Results

Conclusions



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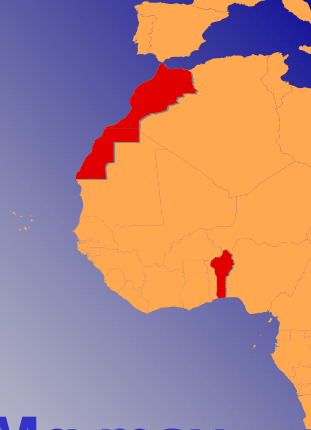


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Conclusions II



→DRIS indices indicate that Zn, Mn, and Mg may

be actually most limiting for higher productivities

→More long term studies are needed to assess the

influence of organic matter

Introduction

Problem

Objectives

Material/Methods

Results

Conclusions

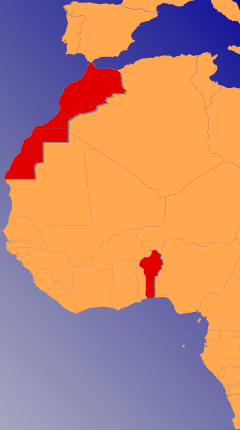


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Thank you for your attention

- Introduction
- Problem
- Objectives
- Material/Methods
- Results
- Conclusions**

