Nursery fertilization of oaks: consequences for plant quality and outplanting

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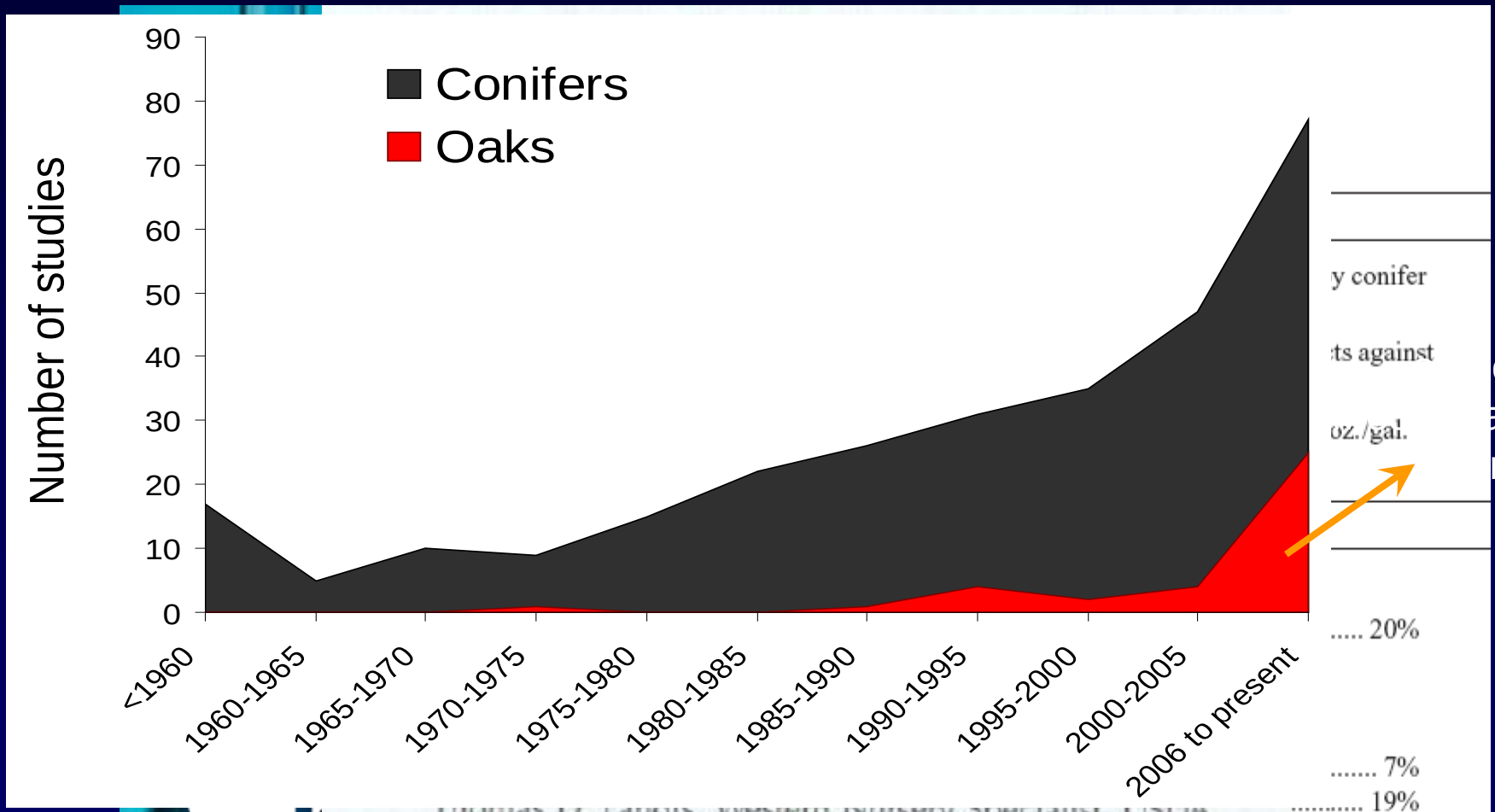
Introduction

Introduction

ISI Web of knowledge: (Fertilization, Nursery) and main (conifer genera)



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Introduction

Objectives

1) Why should Mediterranean oak seedlings be fertilized?

Importance of (nitrogen) fertilization on seedling quality and out-planting performance of Mediterranean oaks

- How much N should be supplied to fertilize oak seedlings?
- When should we start N supply?
- Several future research lines

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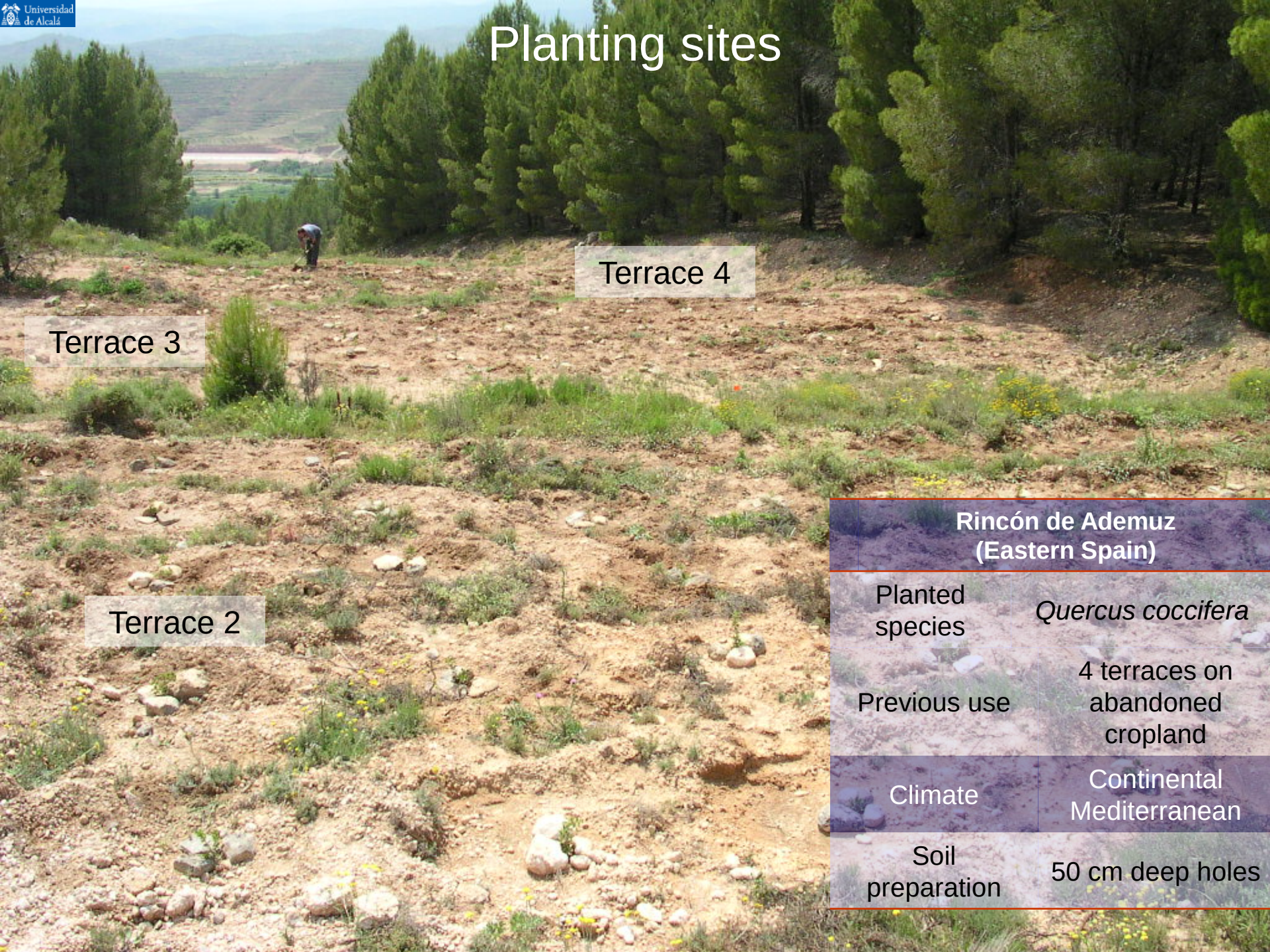
Why should we fertilize oaks in the nursery?

Methodology

Experiment 1

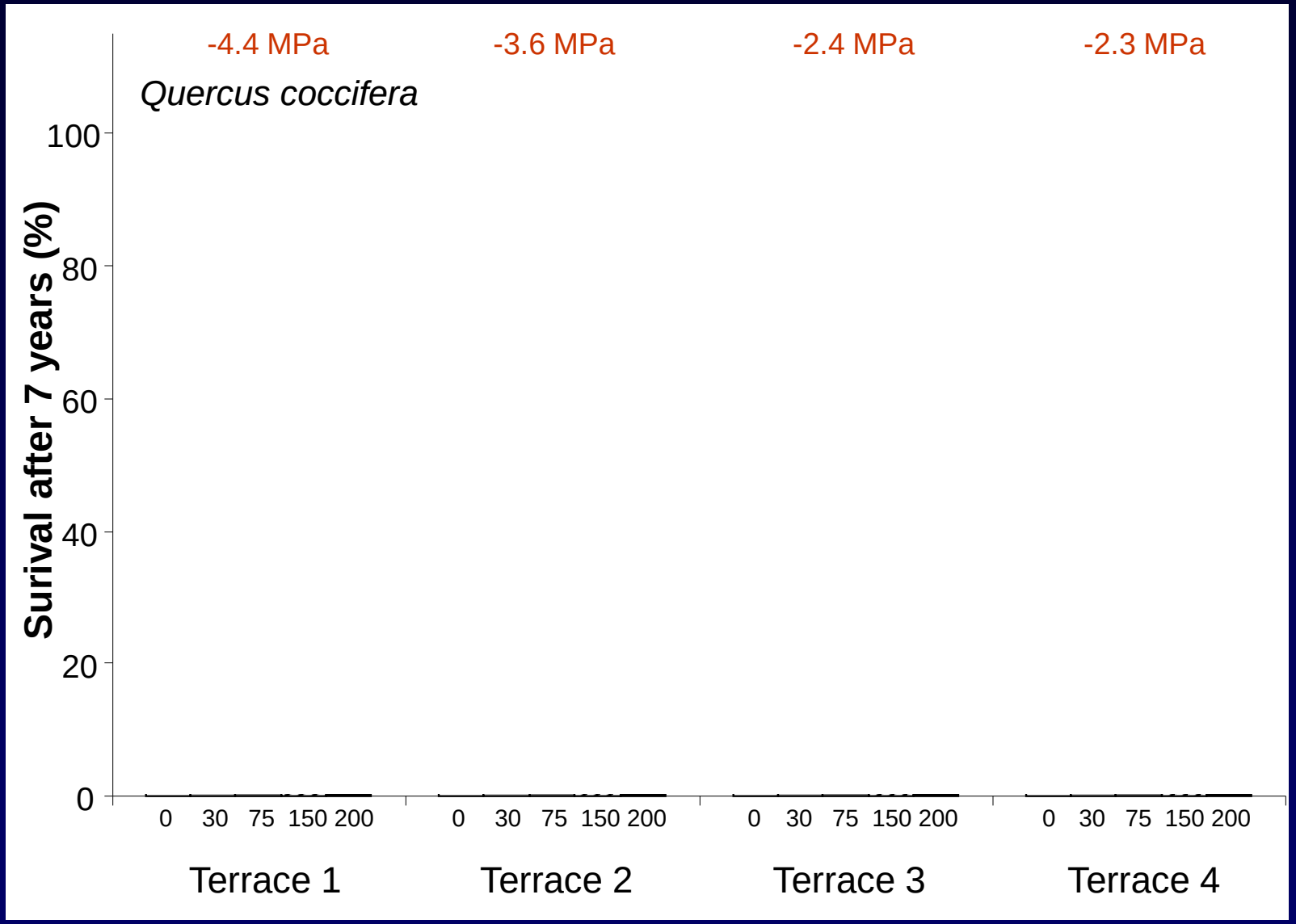
- Container: 300 ml
- P and K constant: 40 and 75 mg plant^{-1}, respectively
- Weekly constant fertilization regime (June-October)

Planting sites



Rincón de Ademuz (Eastern Spain)	
Planted species	*Quercus coccifera*
Previous use	4 terraces on abandoned cropland
Climate	Continental Mediterranean
Soil preparation	50 cm deep holes

Why should we fertilize oaks in the nursery?



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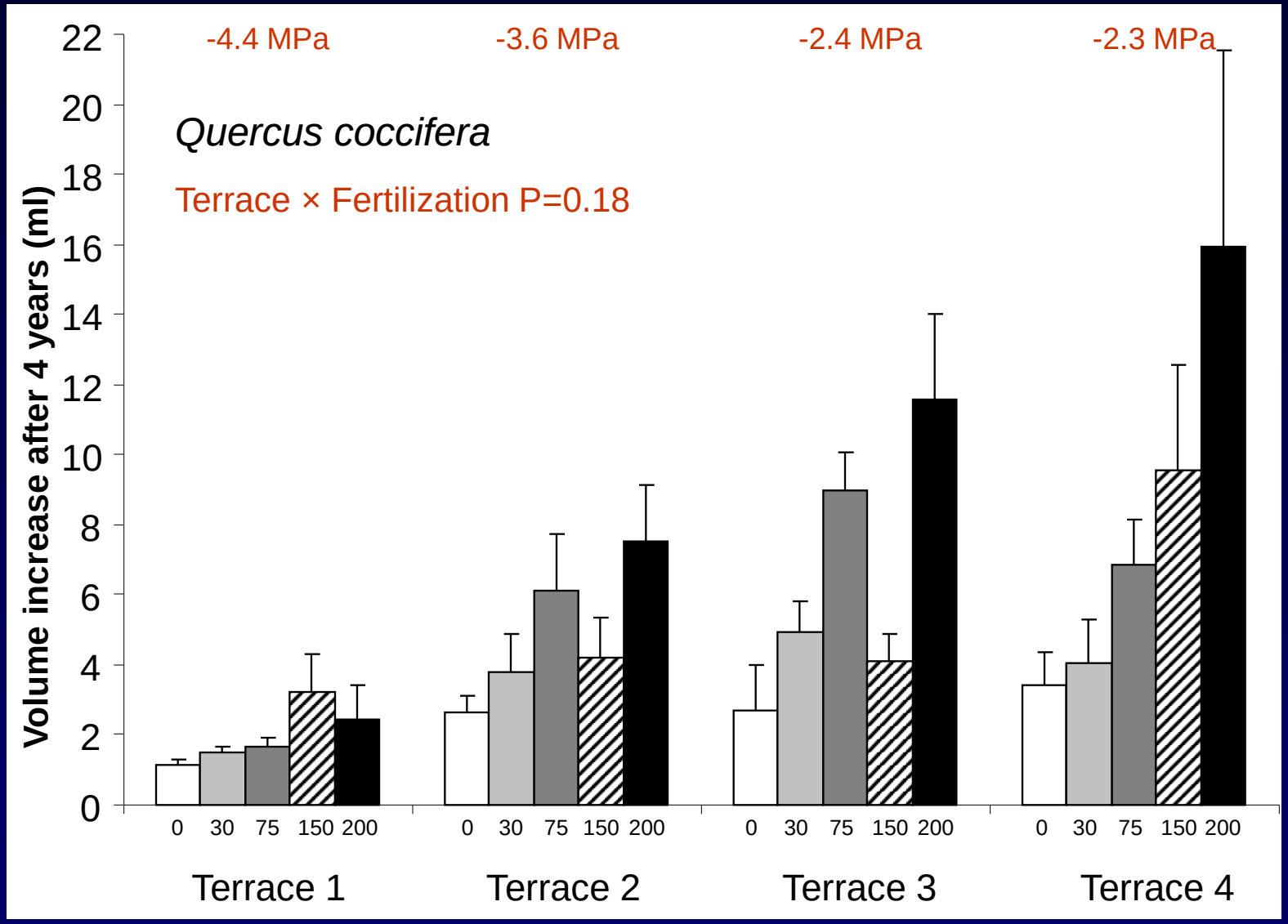

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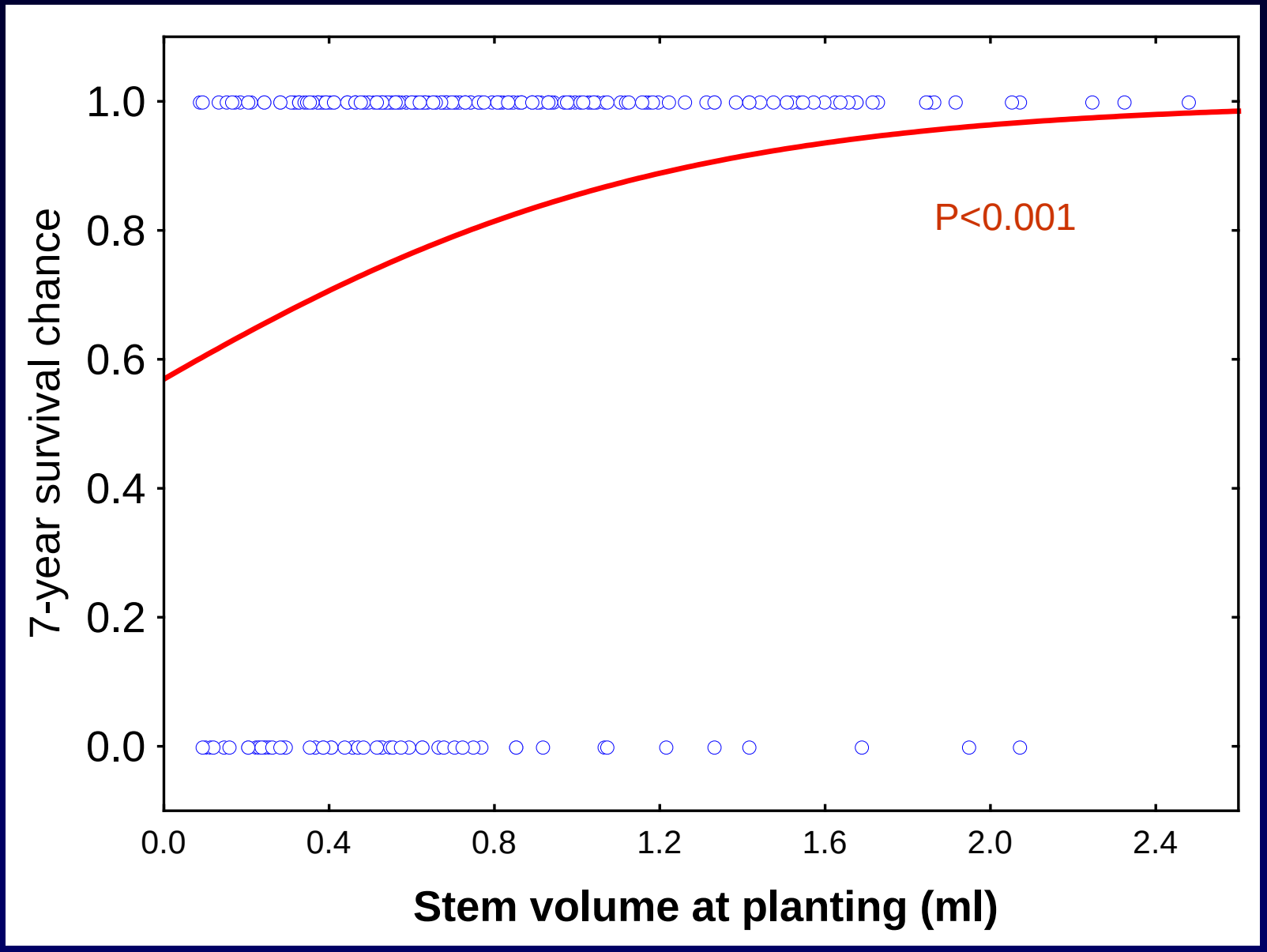
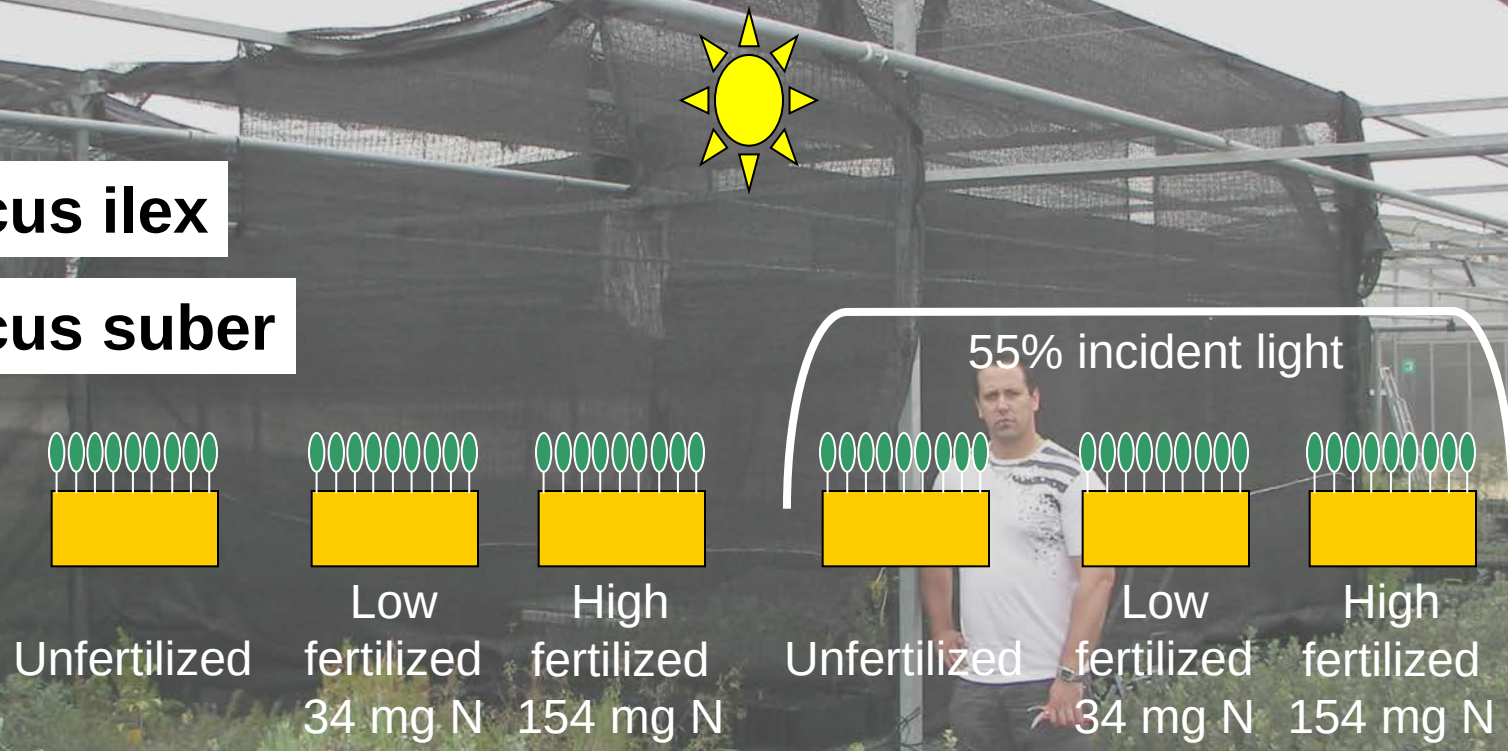


Methodology

Experiment 2

Quercus ilex

Quercus suber

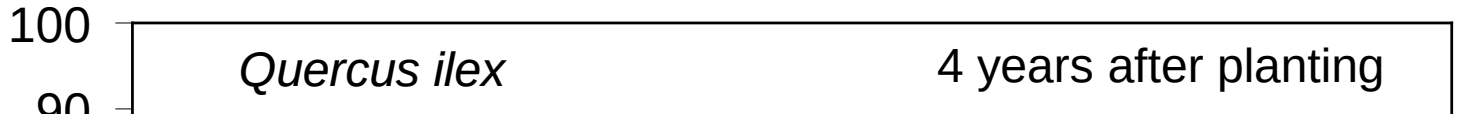


- Container: 300 ml
- P and K constant: 16 and 34 mg plant^{-1}, respectively
- Weekly, constant fertilization regime (June-mid September)

Planting sites

Santorcaz (Central Spain)	
Planted species	*Quercus ilex*
Previous use	Abandoned cropland
Climate	Continental Mediterranean
Soil preparation	Subsoiling

Why should we fertilize oaks in the nursery?



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Forest Ecology and Management 196 (2004) 257–266

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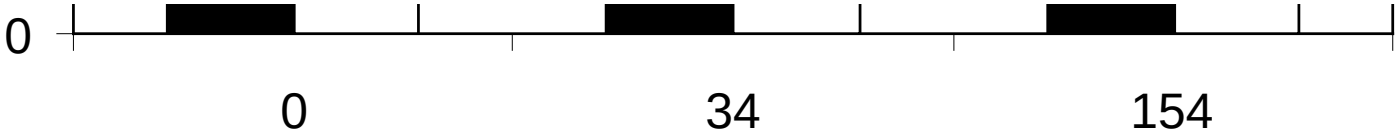
Nursery cultivation regimes, plant functional attributes, and field performance relationships in the Mediterranean oak *Quercus ilex* L.

P. Villar-Salvador[a,*], R. Planelles[b,1], E. Enríquez[c], J. Peñuelas Rubira[a]

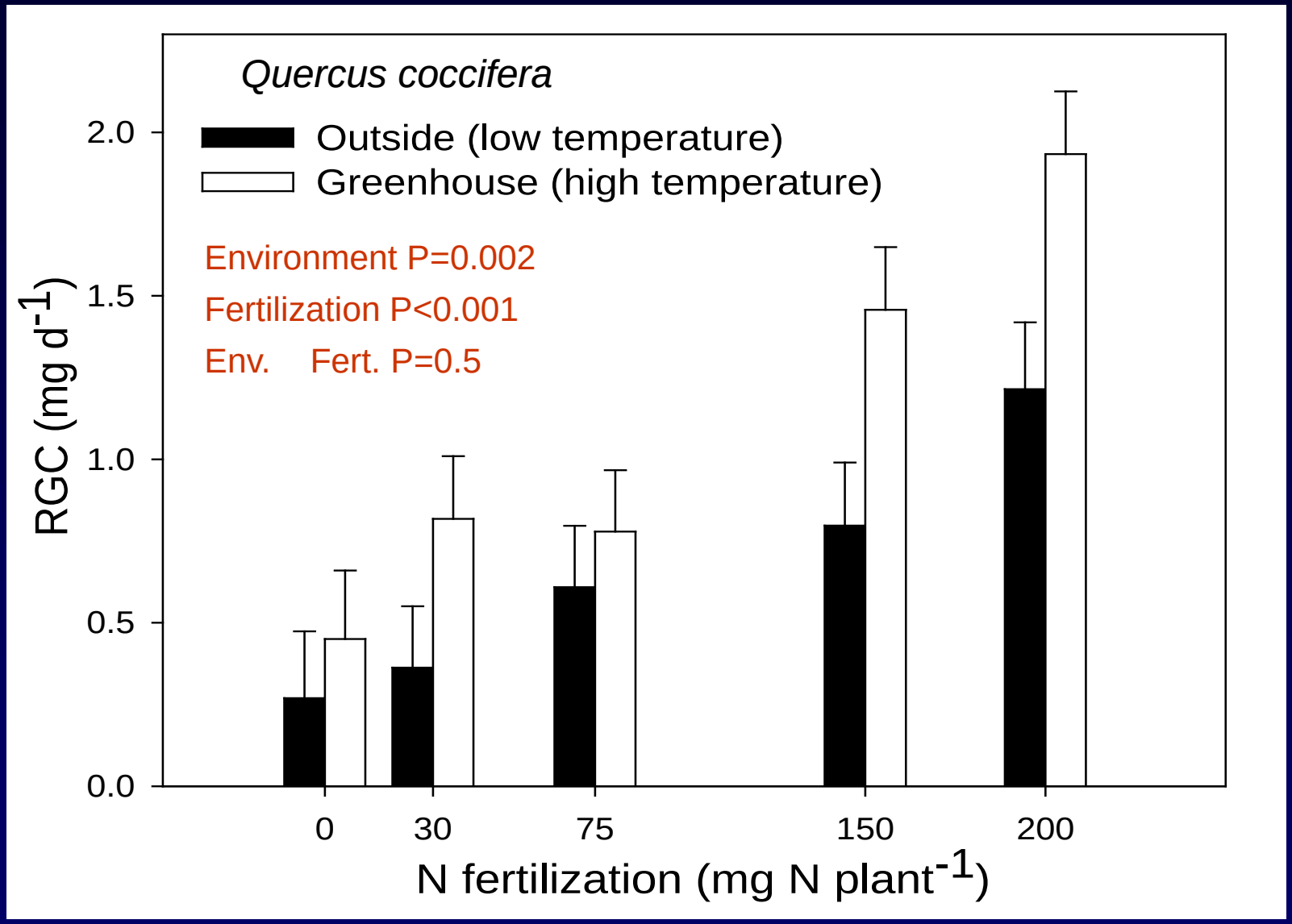


N fertilization and oak seedling quality

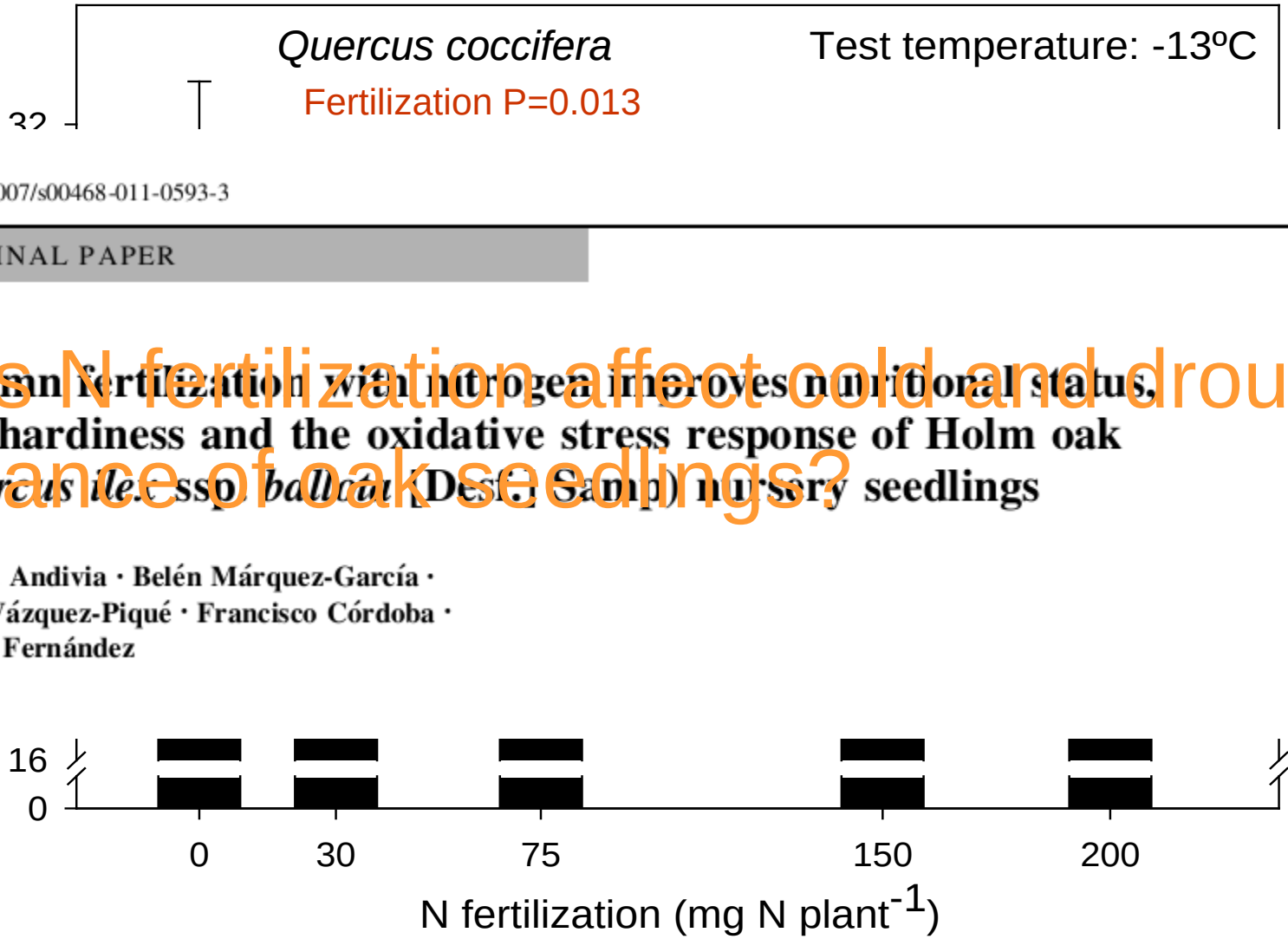
N fertilization effect on plant quality: Root growth capacity

RGC= New roots mass / time (mg d^{-1})

N fertilization effect on plant quality: Root growth capacity



N fertilization effect on plant quality: cold tolerance



Trees
DOI 10.1007/s00468-011-0593-3

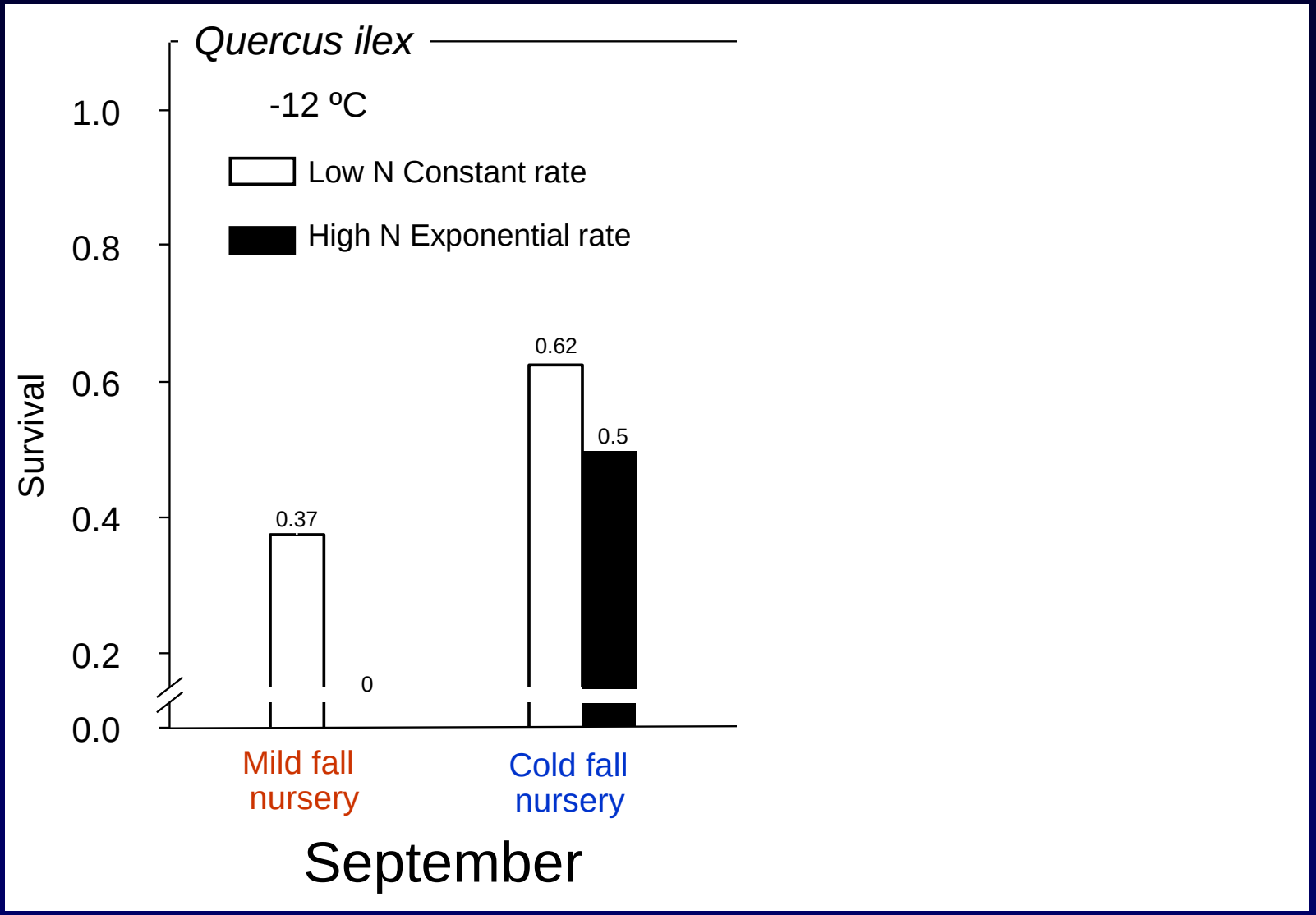
ORIGINAL PAPER

Autumn fertilization with nitrogen improves nutritional status, cold hardiness and the oxidative stress response of Holm oak (*Quercus ilex* ssp. *ballota* [Desf.] Samp.) nursery seedlings

Enrique Andivia · Belén Márquez-García · Javier Vázquez-Piqué · Francisco Córdoba · Manuel Fernández

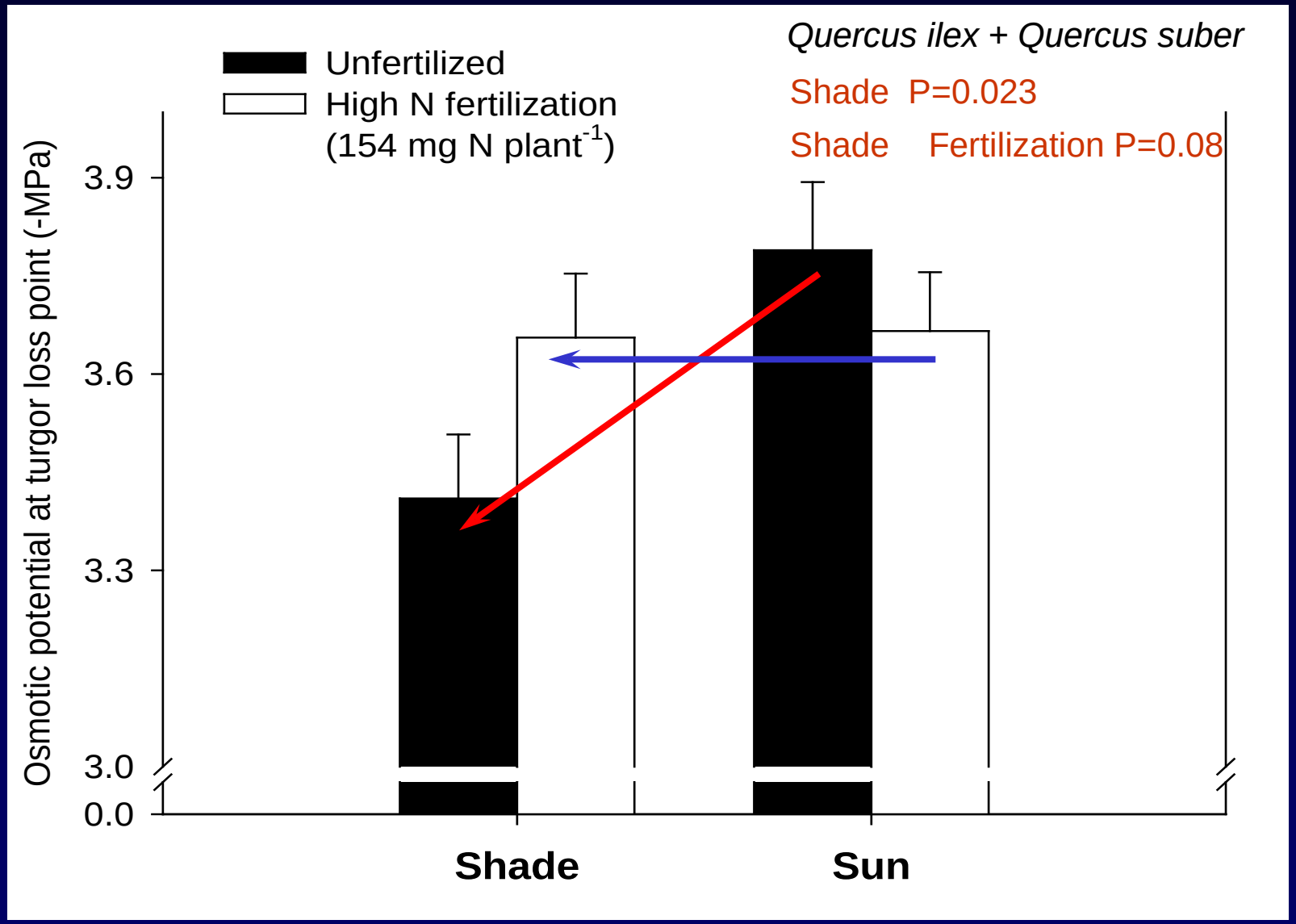
Does N fertilization affect cold and drought tolerance of oak seedlings?

N fertilization effect on plant quality: cold tolerance



Heredia *et al.* in preparation

N fertilization effect on plant quality: drought tolerance



How much nitrogen

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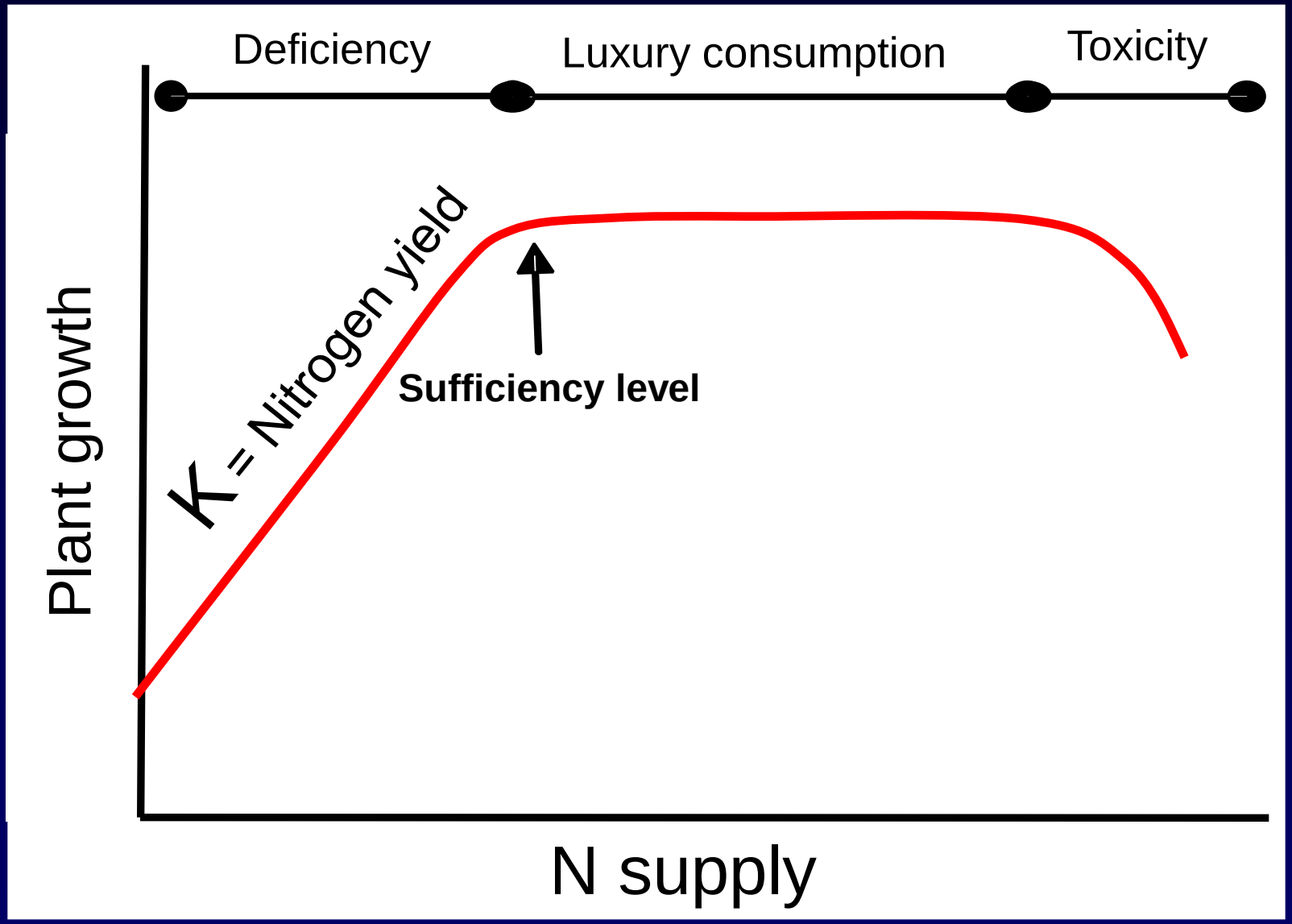

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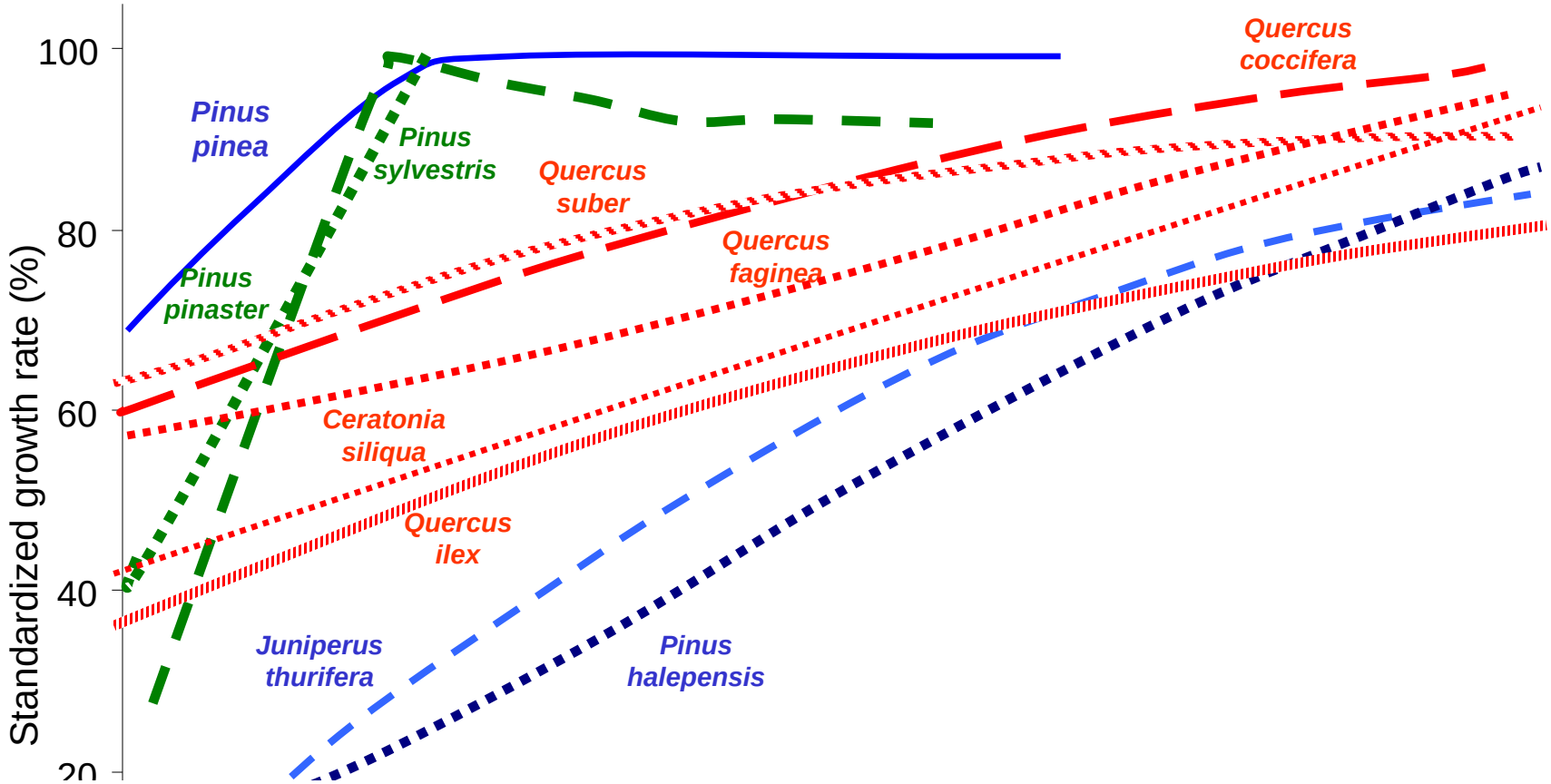
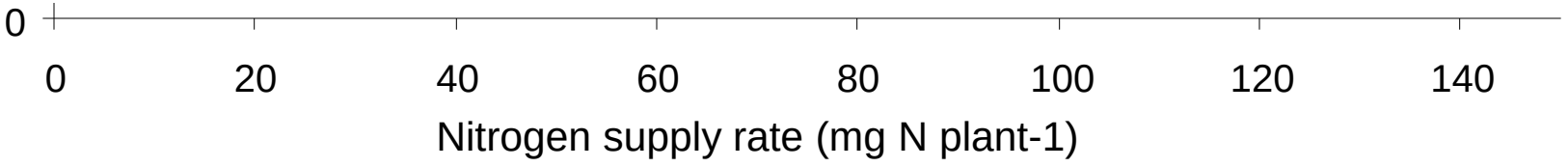


Mediterranean oaks have low N yield so they need to receive high N fertilization rates to maximize growth



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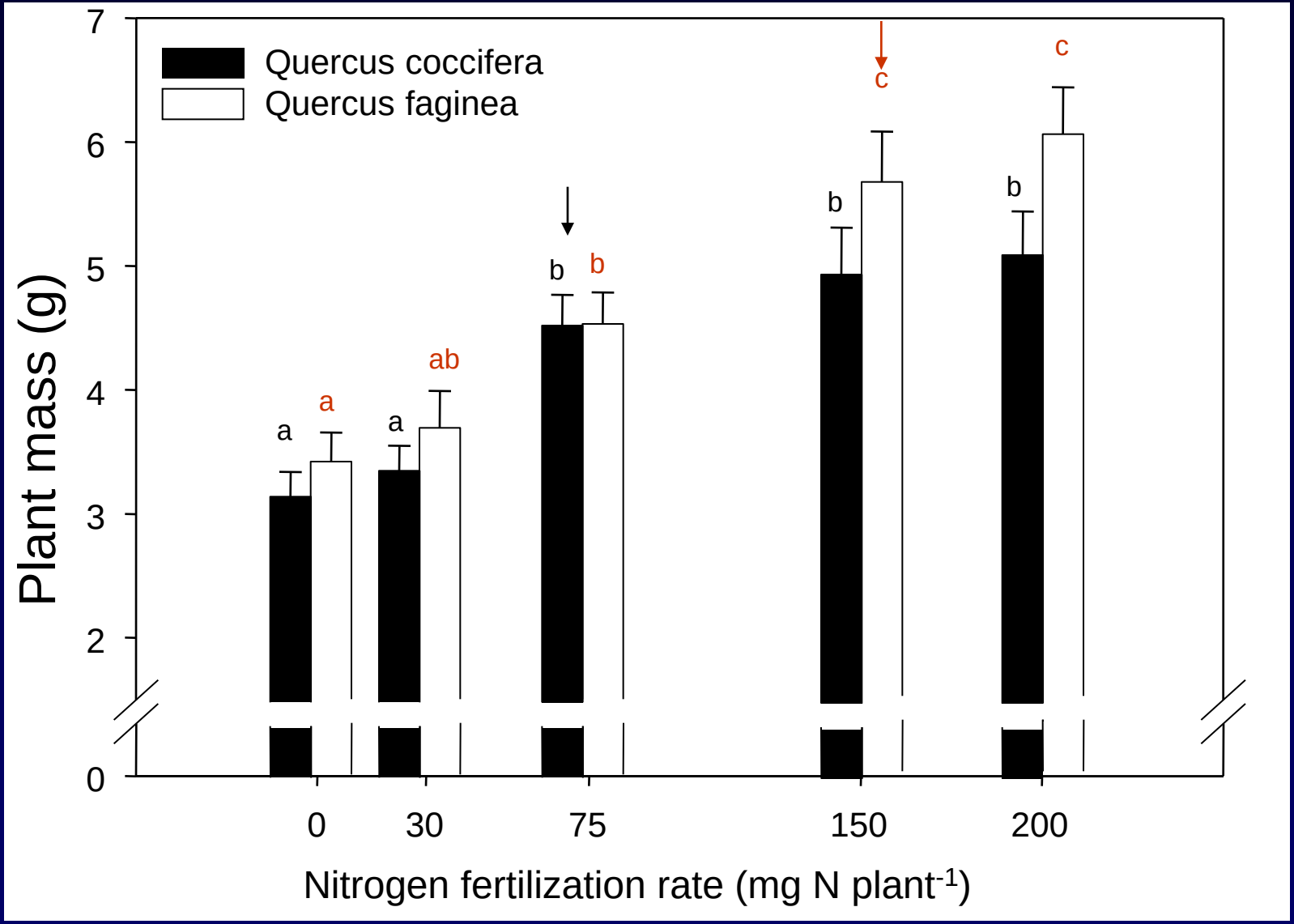

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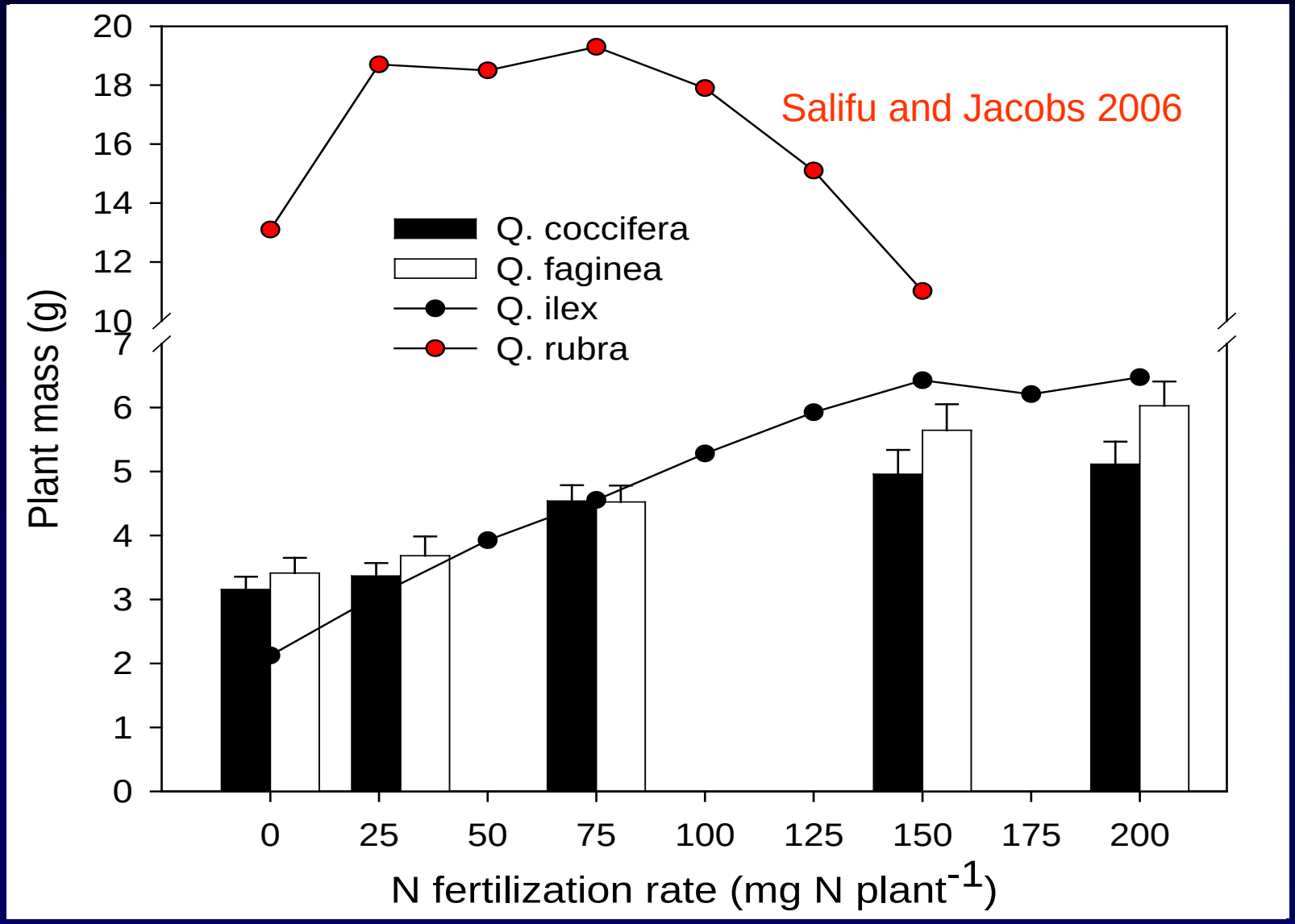

When should we start oak fertilization?

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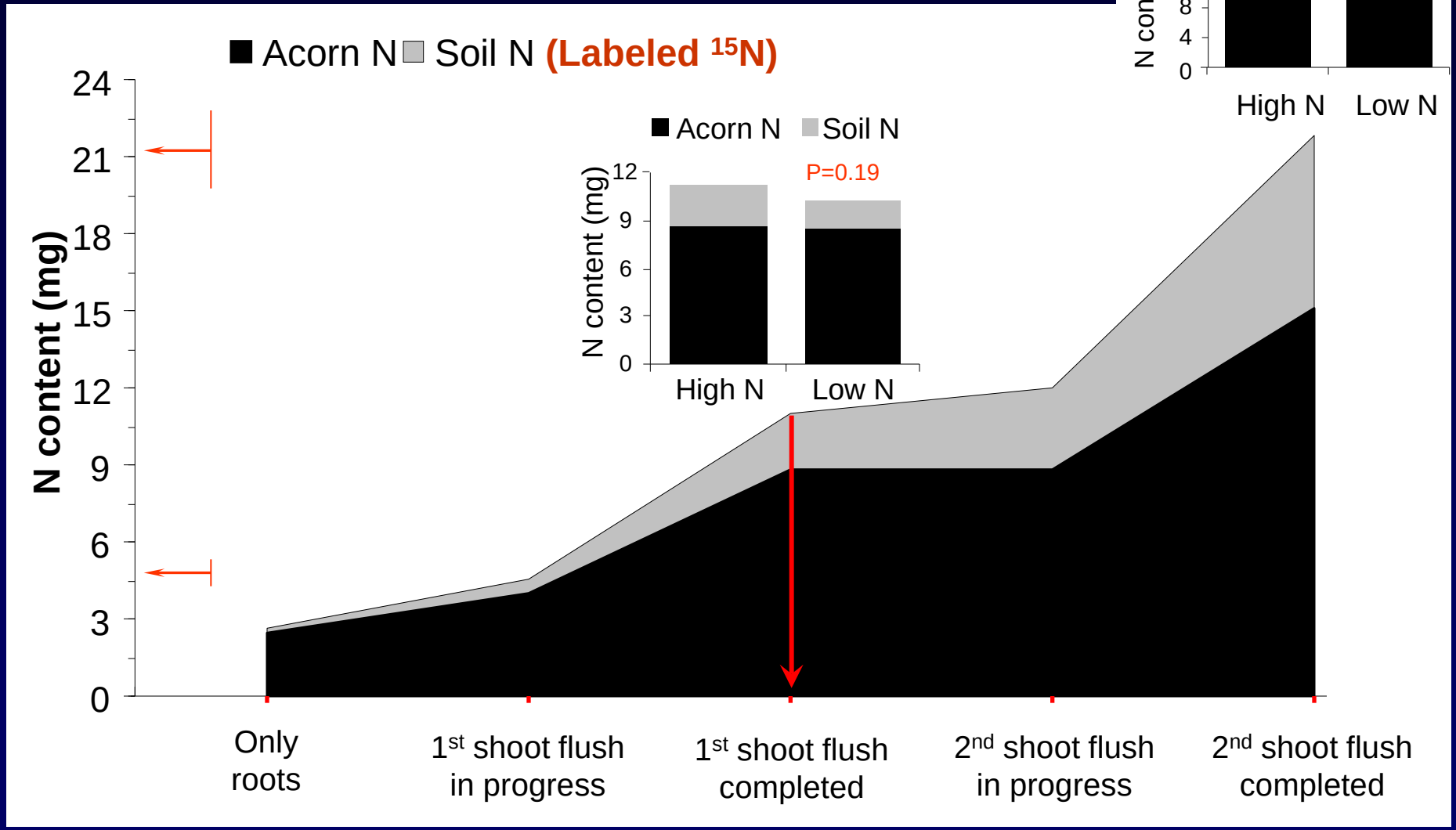
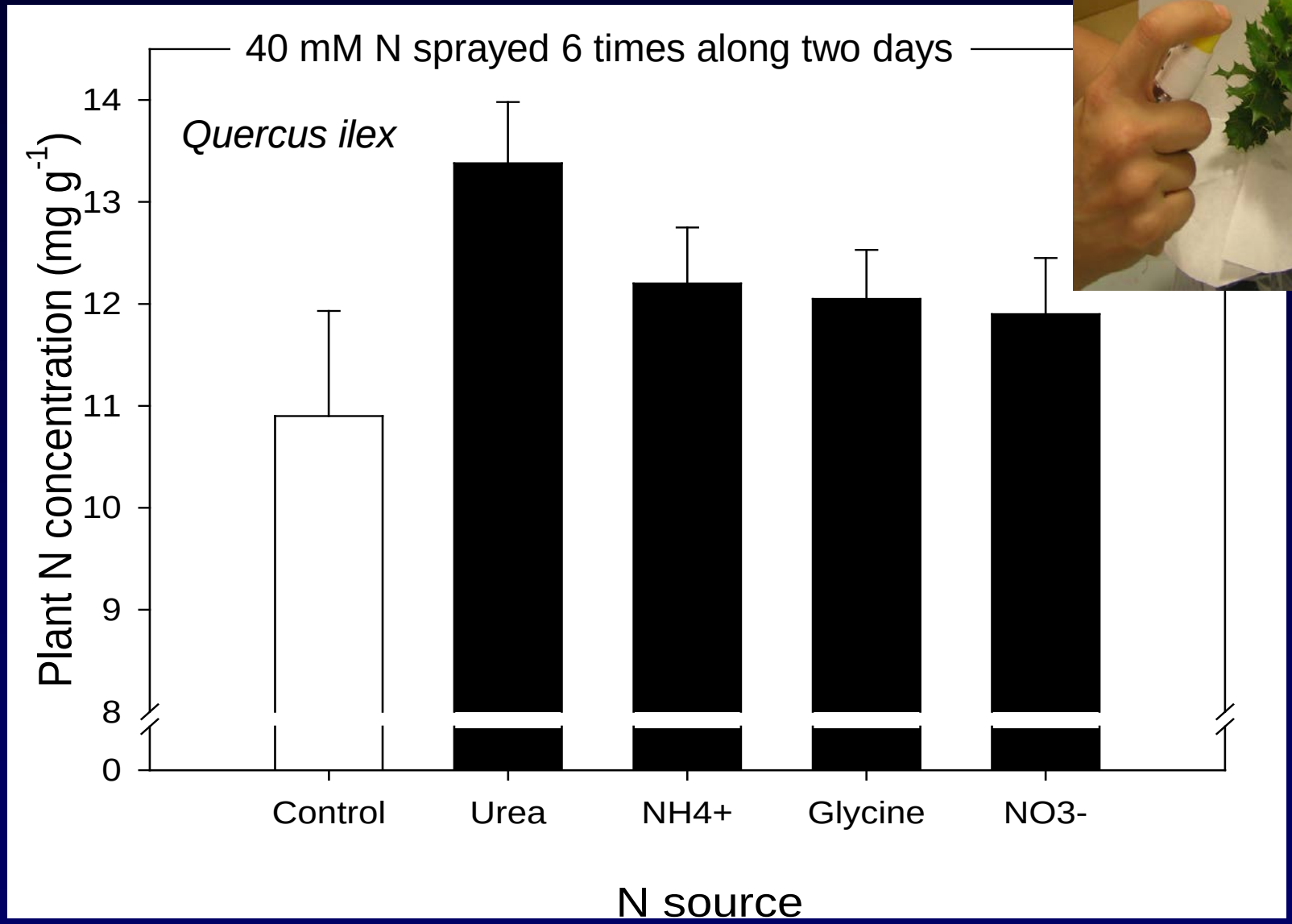
Quercus ilex



Villar-Salvador et al. 2010 Tree Physiol.

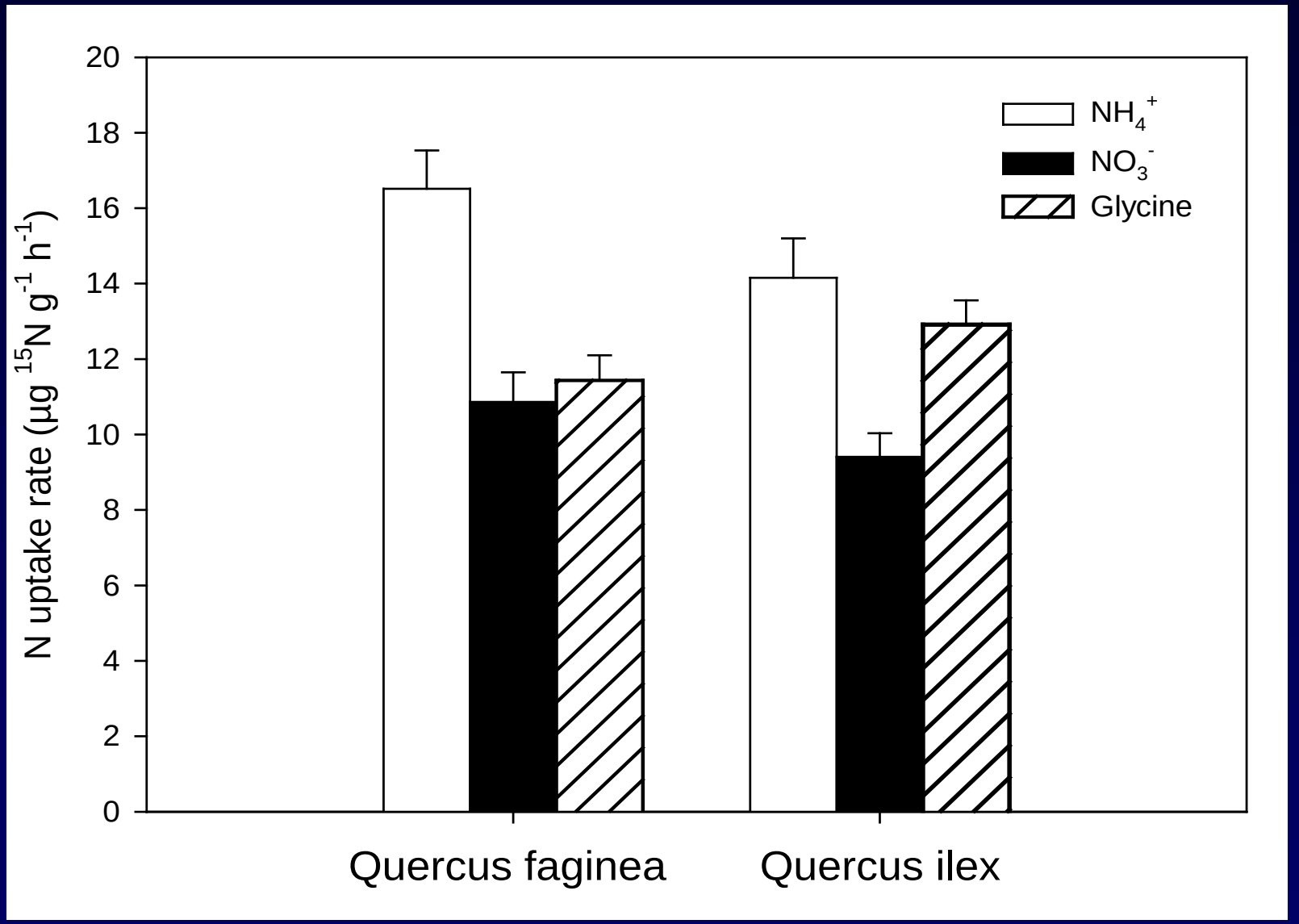
Future research

Future research: can foliar fertilization help N loading?



Uscola et al. *in preparation*

Future research: N sources



Uscola et al. *in preparation*

Conclusions

Why should Mediterranean oak seedlings be fertilized?

Because out-planting performance of Mediterranean oak seedlings is strongly improved by nursery fertilization.

Moderate to high N fertilization increases seedling vigor as measured by root growth capacity

Very low N fertilization hinders stress tolerance of oak seedlings. High N fertilization does not necessary reduce stress tolerance of oak seedlings in cold winter nurseries, although it might reduce it in mild winter ones.

Conclusions

How much N should be supplied to fertilize oak seedlings?

Mediterranean oaks have low N yield when compared with other Mediterranean woody species. Consequently, N sufficiency levels are high (75-150 mg N plant^{-1}), but this probably is not a specific trait of oaks from other biomes.

When should we start N supply?

To improve fertilizer use efficiency, early fertilization should be avoided in oak seedlings because dependence on N acorn is very high. For instance, *Q. ilex* fertilization should start at the beginning of the second shoot flush of growth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Thank you!